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Interference with Radio Reception

THE chief difficulty in obtaining satisfactory reception of broadcasting programmes is due to the operation of electrical machinery. This difficulty is rapidly becoming more pronounced owing to the increasing use of all-mains sets, their improved sensitivity, and the greater number of motors in use, especially on domestic premises.

Of the three causes of disturbance—direct and mains-borne radiation and conducted interference—the second is the most troublesome, as it has a much greater range than direct radiation, which is usually noticeable only within 200 or 300 yards of the source; the severity of conducted interference is a very variable factor, but is not usually important with modern receivers.

In his paper before the I.E.E. Wireless Section on Wednesday, Mr. A. Morris rightly emphasised the desirability of suppressing interference at the source. Where the source is industrial, mains-borne radiation can be prevented by suitable chokes and condensers. The small size of domestic appliances makes suppression more difficult, but often quite simple devices can be included in the connector for the purpose.

It should be unnecessary, in most cases, to incur expense in connection with existing apparatus, but any delay in providing for the future will considerably increase the cost of work which will have to be done at some time.

Suppression at the source, although the best method, may be expensive, and the British National Committee (which is the British Standards Institution) of the International Electro-Technical Commission is playing a leading part in investigating methods of eliminating interference at other points. Investigations are also being carried out on larger plant by the Electrical Research Association.

Suppression presents few technical difficulties. It is chiefly a question as to which party should bear the cost—the owner of the receiving set, the consumer causing the disturbance, or the supply authority. Under the Electricity Supply Act of 1882 a consumer is not permitted to use electricity in such a way as to interfere unduly with the supply to another consumer, but broadcasting could not have been foreseen when framing the Act, and it must make the best of its position as second-comer.

The Electricity Commissioners are making representations to supply undertakings regarding interference due to faulty maintenance of motors, and the Postmaster-General, who has no statutory powers in this respect, is using his influence to reconcile conflicting interests; but it is unsatisfactory that so important a subject should be left to bargaining.

We are almost all users of receiving sets now; this provides that touch of nature necessary to create a feeling of kinship that will probably prove a solvent of conflicting interests. This harmony should provide a good basis for such legislation as may be needed to ensure that British manufacturers who co-operate in providing what may be required by the electrical industry as a whole shall not suffer from the competition of imported electrical apparatus that may be slightly cheaper owing to the omission from the design of provisions to prevent interference.

Progress at Spalding

SPALDING is one of the small undertakings which lends support to the view held by many that mere size is not the only important factor in efficient distribution. The town is at the centre of a thinly populated area of 104,000 acres and one half of its 2,500 consumers (out of a population of 13,000) live in a rural area which is now practically covered by an 11-kV network. As the undertaking receives a bulk supply, partly from Peterborough Corporation and partly from the Central Electricity Board, it had no initial charges to meet on generating plant while building up the load. There are few large power consumers in the area, but supplies are given to a beet sugar works, a canning factory and a pumping station. The domestic load is being encouraged by an all-in net rate of 0.9d. per kWh; energy for water heating is charged at ¾d., less 25 per

cent. per kWh in excess of 1,000 per quarter. The undertaking, of which Mr. F. R. C. Roberts is engineer and manager, started operations in 1927. In that year the net loss was £1,500. The most recent figures show that a net profit of about £2,000 (gross £6,000) is being made, thus illustrating the principle that those who are unafraid of losses through rapid development in the early stages are most likely to be rewarded by success in the long run.

Audacity

FACED with the prospect of the gradual loss of the street-lighting business, the gas industry is being compelled to look around to find something to fill up the gap. At least this is what we would judge from a picture appearing in one of the dailies this week. It is a view of Exeter Cathedral beautifully illuminated by means of what is described as gas floodlighting. This is a brave effort (and not the first, we believe), but surely the gas people do not seriously contemplate wresting the floodlighting business from the electrical industry. They might, of course, succeed in selling combined floodlighting *and* heating installations for the exteriors of buildings.

A Large Diesel Station

THE 25,000-kW. station recently put into commission in Vermont, California, is the largest, so far as we are aware, to rely entirely on Diesel engines. The overall efficiency on test of 37.5 per cent. (at $\frac{3}{4}$ load, the most economical point) considerably exceeds that of any steam station. Results of operation over a year will show whether the use of 900 b.h.p. per cylinder enables any marked advance to be made upon the thermal efficiency of 30.64 per cent. attained by Buxton last year. The size of the sets is small for modern conditions; this entails higher capital cost and greater floor area than would be required for the large steam turbines employed with interconnected stations, and we should not expect the success of this station to influence appreciably power station design in this country. We are impressed by the claim that operation from a cold start can be brought about in less than two minutes, as this is a pointer towards the direction in which considerable scope may be found for the Diesel engine.

Clearing Up Ambiguity

FOR the proper working out of the grid scheme it is essential that the Central Electricity Board should act as an ordinary undertaking selling electricity in bulk. Other undertakings come up against ambiguities in the various Acts, but usually get over them by agreement with their consumers; both parties being satisfied, there are no legal quibbles. The Central Board is, perhaps, in a more obvious position to be tripped up by legal subtleties. It proposed, we learn from a local newspaper, to enter into an agreement with Taunton Corporation, presumably to the benefit of the latter's consumers, on terms acceptable to both parties. Unfortunately, the Corporation took counsel's opinion, which decided that the terms were *ultra vires*; this opinion was directly opposed to that of another eminent K.C. The result is that the Corporation is promoting a short Bill to clear up the ambiguity. It is a great pity that expense should be incurred and time wasted to make sure that the Corporation is entitled to do what its ratepayers wish and that the C.E.B. is authorised to carry out the work for which it was created.

The Electric Kitchen

PARTICULARS have been issued of the competition for designs of electric kitchens for small houses or flats, which has been organised by E.D.A. The idea in the minds of those responsible for the competition is that the future kitchen will be all-electric, that is, will include electric cooking, washing, ironing and efficient lighting. Competitors have to submit plan and elevation drawings of the interior finish and decoration, complete with equipment and fittings. Workmanlike arrangement, paying special attention to sink and fixtures as well as electrical appliances, regarded from the point of view of compact design and other merits, will count materially. The names of the assessors are given, together with some other details, on page 744 of this issue. Designs have to be submitted by January 15th, and the conditions of the competition can be obtained in exchange for one shilling from the E.D.A. offices at 2, Savoy Hill, W.C.2. We commend the effort to the serious attention of our readers, and hope that as a result E.D.A. will be deluged with original and practical ideas.

Cheap and Dangerous

THE admirable manner in which electricity lends itself to decorative arrangements makes it all the more necessary to ensure that the lighting equipments sold at this time of the year should be danger-proof so far as is humanly possible—all the more so as there is a likelihood of children handling them. The reputation of the maker is of the greatest importance in choosing such equipments, and those provided by leading British firms may be safely used. Some of foreign makes, consisting of lamps connected in series with wire that is really only fit for use in bell circuits, are available at a very low price, but these should on no account be purchased. Insulation of the lampholder is so short that about $\frac{1}{4}$ in. of the lampcap, which is alive, is exposed, so that shock could easily be obtained to earth. Moreover, these outfits are often used on a Christmas tree in conjunction with tinsel made from metal foil, which increases the risk. We emphasise this in view of the natural temptation to purchasers to regard cheapness as an important consideration in view of the temporary character of the illuminations; but anyone who has examined these products with a critical eye will realise that the responsibility attaching to their use is a heavy one.

Demonstrators' Qualifications

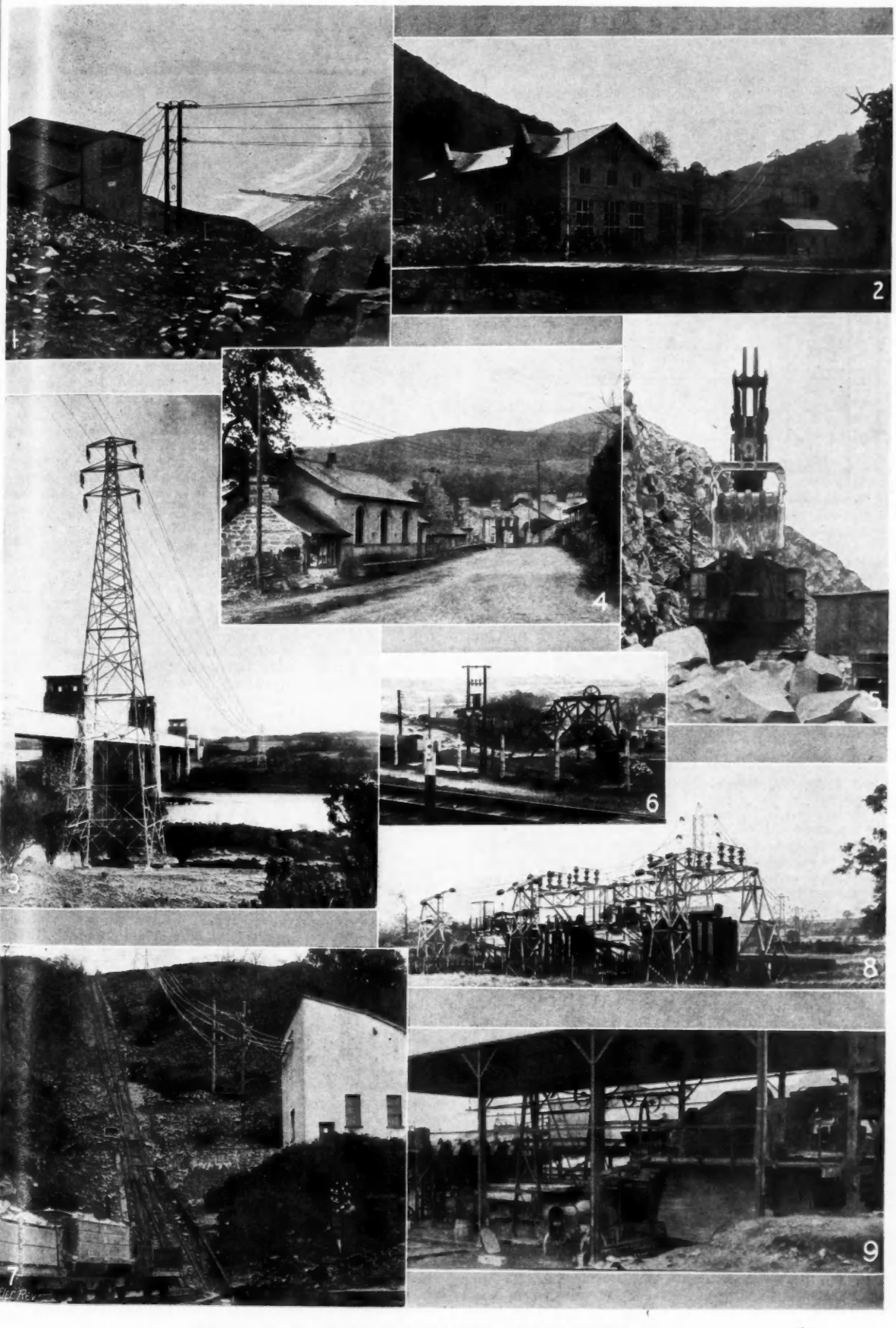
THE procedure for obtaining a Diploma of the Electrical Association for Women, reported on a later page, indicates a rapid working-up in the usual manner of professional associations to the attainment of professional standard by scrutiny of entrance qualifications, after having provided opportunities for those who have shown by practical work in the industry that they have merited their status as the result of experience.

Tenure and Development

THE inquiry which the Electricity Commissioners intend to hold on January 2nd has reference to a draft agreement between the London and Home Counties Joint Electricity Authority and the Northmet Co. There are several local authorities in the Northmet area whose purchase rights are maturing, and we may take it that the J.E.A., in pursuit of its policy of preventing the cutting up of areas, is acting as "honest broker" between the parties. It is clearly against the trend of electrical policy that an undertaking which has power supply rights in perpetuity should lose the distribution powers which it is effectively using. No doubt some *quid pro quo* will be demanded by the local authorities: this should be in line with the London Power Companies Acts (Nos. 1 and 2), which consider the interests of the consumers, and not in the form of a dole to the ratepayers as a whole.

An Unusual Incident

SHUT-DOWNS due to small fauna are not infrequent, but it is seldom, we think, that flora cause trouble of this nature. A correspondent tells us that a fern recently short-circuited the contacts in a transformer kiosk belonging to his undertaking. While we do not doubt the authenticity of the story, the incident is strongly reminiscent of an older tale—the fern was a large one, and must have sprung up very quickly to have escaped earlier detection. Such an incident appears to call for more frequent plant inspection.



Parts of the North Wales System. **(See page 727)**

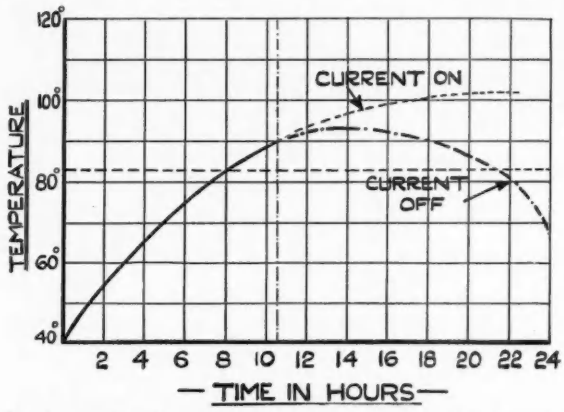
1. The No. 4 sub-station and 20-kV incoming line at Penmaenmawr quarries. 2. The Maentwrog power station. 3. The Menai Straits crossing. 4. Maentwrog village—single-phase line with third wire for public light switching. 5. A "Bucyrus" navvy at the Penmaenmawr quarries. 6. The Wrexham Water Co.'s new pumping station. 7. The No. 2 sub-station on an incline at the quarries. 8. The Legacy 66/33-kV sub-station with 66-kV line to Maentwrog on the right. 9. Crushing, washing and flotation plant at the Halkyn lead works

Electricity in Horticulture. By S. F. Osborne

Hastening the use of electricity for soil heating

THE horticulturist's turning-point was reached in 1932, when the first duties were placed on foreign produce; now that the industry is well on its way back to prosperity the leading nurserymen should be introduced to the many advantages of electricity in the garden and glasshouse.

According to the British Glasshouse Produce Marketing Association, during the past twelve months nurseries with a total area of at least four million sq. ft. have been erected. What



Heating and cooling curves of an efficiently heated frame, the temperature recorded being the average of those taken at various points of the frame

have the electricity undertakings done to bring electricity into its full use for space heating, insect trapping, fruit ripening, soil sterilising, and soil heating?

Some undertakings have completed electrical soil-heating installations for consumers free of charge, and have thus given definite proof that this method is not only practicable and technically sound, but the cheapest and most satisfactory method of providing bottom heat.

Methods of Installation

There are four methods by which the installation may be carried out:—

1. By specially designed cables buried directly in the soil and connected direct to 200- to 230-V mains.
2. Bare-metal wire buried in the soil and connected to the low-voltage side of a step-down transformer having a secondary voltage of 10 to 20 V, the primary side being connected to the usual 200- to 230-V mains.
3. By inserting copper plates at a suitable distance apart in the soil and passing the current through the soil from plate to plate.
4. A framework of electrically heated metallic tubes fitted in a space provided below the bed of the frame or propagator.

Methods 1 and 2 are the most extensively used, but method 4, although the most expensive in first cost, has an advantage, inasmuch as the frame can be moved from any bed not in use and placed in any other position required. The main difficulties encountered in method 3 are: (*a*) The drying-out of the soil at the plates, causing a decrease in the current; and (*b*) the action of chemicals in the soil upon the plates, particularly when d.c. is used.

The importance of providing heat insulation, such as clinkers, ashes, or coke, below and round the sides of the outdoor frame cannot be over-stressed, as a saving in current consumption of 20 per cent. can thereby be effected. A further saving is also obtained by covering the frame with straw or canvas during the night.

Correct Loadings

The loading should be such that the soil will reach the maximum temperature required within about ten hours from the time it is switched on, thus enabling the user to obtain the benefits of any low rate of supply offered for night or off-peak loads. If the correct temperature is not reached during the night there will be a drop during the day below that required for successful results; 15 per cent. above normal would not, except in special cases, affect the growth of the crop.

An installation arranged to raise the temperature to the required level in one night calls for a much heavier loading than might otherwise be required, and thus increases the first cost. In such cases a lighter loading could be used and the installation be switched on several nights before being put into use. This, however, detracts from the advantages of the electrical method, since it retains one of the disadvantages of the ordinary manure hot-beds.

Though thermostats add to the first cost, their use is strongly urged in installations designed to reach the normal temperature from cold during the first night, as such installations would naturally become over-heated on subsequent nights if switched on for the same period each night. If a time switch is used in the place of a thermostat this can be reset to reduce the switched-on periods after the first night; but, as the supply authority's time switch would be sealed when night load is taken, a second time switch is necessary.

The Consumption of Energy

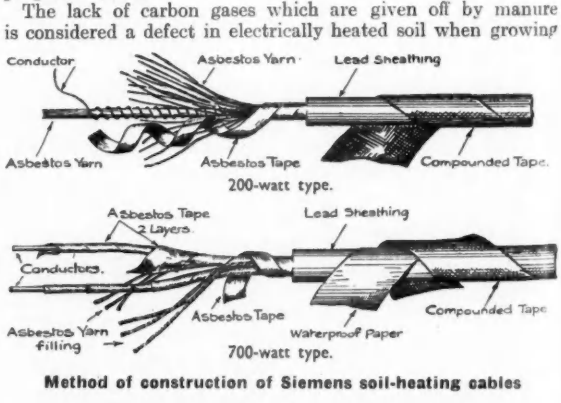
It is difficult to calculate the consumption over a given period for an outdoor frame as the losses depend upon the difference between the temperature of the soil and that of the outside air. For electrical installations used to provide bottom heat in a glass house which is space heated by the usual hot-water pipes the losses are almost constant and the consumption can be calculated with considerable accuracy. Where the space heating is carried out by thermostatically controlled electric tubular heaters or even a modern hot-water heating installation with rod thermostats, the air temperature can be kept almost constant.

In such cases the consumption of the electric soil heating installation can be calculated within 5 per cent. of the actual metered energy. The supply undertaking, if necessary, could quote a definite fixed charge for the energy consumed by the installation for the growth of a given crop, having first ascertained the time and temperature required for that particular crop. On giving such a figure it should be agreed that the installation should be either time-switch or thermostatically controlled, for any wide variations in temperature would greatly affect the consumption of energy.

As a result of experiments we now have figures giving the energy used in heat losses per cubic foot of soil per degree rise in temperature for different types of installations. The energy required to bring the soil up to the required temperature varies according to the type of soil, as the specific heat of the various soils differs. The amount of energy required to bring the soil from cold is so small compared with the total energy used to maintain the soil at normal temperature that an accurate calculation of this figure is not necessary.

Though we have many experimental results giving the installation costs and the amount of power consumed for the growth of various crops, and, more important, the increase in yield from soil electrically heated as compared with naturally heated beds, we still find that an increasing number of authorities continue to experiment on lines similar to those from which existing results have been obtained and thus little progress is made.

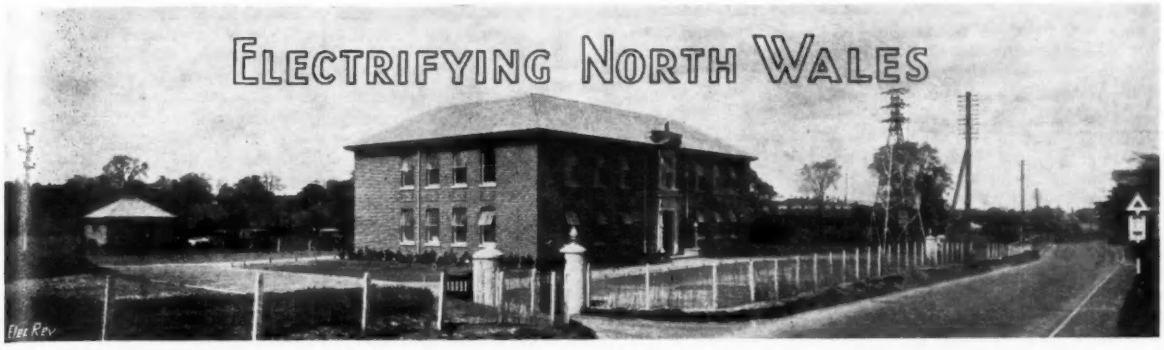
The lack of carbon gases which are given off by manure is considered a defect in electrically heated soil when growing



Method of construction of Siemens soil-heating cables

some crops. A good supply of plant food which is given by manure is also necessary in others. For example, an adequate supply of cellulose in the manure used for the growth of mushrooms is of great importance, for this is the carbohydrate food of this fungus. Further experimental work should be conducted on such lines in order to determine the exact amount of manure required to provide the plant food when the heat is provided electrically, and to what extent artificial means may be successfully substituted in the place of the natural food that manure provides.

ELECTRIFYING NORTH WALES



WITH the readily granted permission and active co-operation of Brig.-Gen. R. F. Legge, D.S.O., director and general manager, we were recently able to make a tour of the area of the North Wales Power Co., Ltd., Mr. R. P. David, the company's power sales engineer, acting as our guide. We first visited the company's headquarters at Rhostyllen depicted above, where we met Mr. G. K. Paton, engineer and manager, who imparted some general information regarding the system.

The three water-power stations at Maentwrog, Cwm Dyli and Dolgarrog, all in the north-west corner of the 4,000-sq. mile area, are connected in a main transmission ring which links Maentwrog and Legacy (near Wrexham) direct by a 66-kV double-circuit steel-mast line, and Legacy and Dolgarrog by a 33-kV pole line which follows the coast line in the north. With the exception of the 66-kV line, the ring and various radiating lines are tapped at many points for supplies to power consumers, and bulk supplies to local authorities and the associated company, Electricity Distribution of North Wales and District, Ltd. The distribution company had an output last year of nine million kWh, and has now over 18,000 consumers. With the exception of Crewe, which has its own supply, there is no town in the company's area with a population of over 25,000.

We were impressed by Mr. Paton's views on rural distribution. The question, he said, was essentially one of service rather than one of cheapness, and it was the building of the North Wales system for power and public supplies which was really bringing about a measure of rural electrification. Legacy sub-station is the linking-up point in the east between the 66-kV and the 33-kV sections of the main ring, and the end of a 33-kV line, which is to link shortly with the grid at Crewe. Further, it will connect, *via* a northerly extension from Crewe, with the Mersey Power Company's system at the Percival Lane power station at Runcorn. Running almost due south from Legacy is an 11-kV line to Oswestry, Welshpool and Newtown, and a 33-kV Rutter line to Oswestry which has just been erected to relieve the original 11-kV line which will still be available for general distribution.

The 66-kV double-circuit line is connected, *via* isolators, straight on to the 7,500-kVA Ferranti transformers. From the 33-kV side the circuits are taken direct without isolators to the 33-kV switchgear in the adjacent indoor sub-station. Outside also there are two 2,500-kVA transformers for 33-kV to 11-kV transformation.

The Hawarden System

On the way north we saw near Caergwrle a good example of an inconspicuous line in the Alyn valley. This runs from Wrexham to Mold, between which places it is tapped for an 11-kV supply to the Hawarden R.D.C. The Llay Main colliery, the largest in the district, is afforded a supply by reciprocal stand-by arrangement. Hawarden R.D.C. has its own system of h.p. distribution which the company feeds at 11 kV from several sub-stations established for other purposes. At Hawarden we saw a typical sectionalising and transforming sub-station in the main ring. The 33-kV line, in and out, also carries an 11-kV circuit.

Further north at Buckley we learned something of the township's main industry—brickmaking. Several brick-fields are supplied by the power company, and electricity is used extensively for haulage from the pits, grinding, mixing and pugging (a modern form of brick-making by extrusion). Some of the concerns use kiln fans for speeding up drying and burning. The largest works has about 100 h.p. of motors installed. At Mold we saw a typical example of a bulk supply arrangement to a small municipality by duplicate h.p. lines fed directly into the Council's own transformer station.

There is a lead mine at Halkyn, where we got some idea of how electricity is used in many installations of this type. Perhaps the bulk is used for compressing air employed in connection with tunnelling operations, while more directly it is used for winding and for crushing and drying the ore. For serving a new shaft at this mine the power company has just established a second outdoor sub-station of 800-kVA capacity, stepping down from 11 to 3 kV; the latter pressure is that at which the motors are to be run. A 3-kV cable will be installed down the shaft for pumps. At the older point of supply electricity is used at 400 V for winding, air compressing and ore crushing and dressing plant. Halkyn is an example of the many small villages which have electricity provided by a near-by power consumer, and here we noticed simple two-wire l.p. distribution serving some very small cottages.

A Colliery and a Textile Mill

Between Halkyn and Holywell we passed Bettisfield Colliery, which takes its entire supply from the power company, including that for the main fan, which has almost a 100 per cent. load factor and is driven by a 200-h.p. motor. Many coal cutters and haulage, pumping, screening and washing operations all account for the extensive use of electricity. Up to about a year ago the company's supply was used mainly as a stand-by, but the colliery has now discarded the whole of its generating plant.

Holywell appears to be mainly a textile centre. A large mill group, which used to generate its own electricity, now, in spite of an extensive use of process steam, takes its supply from the power company, and about 150 kW is accounted for for such purposes as carding, spinning, weaving, and finishing. At Prestatyn we commented on a joint electricity and gas showroom that we noticed, and were told that such an arrangement is quite a common one in North Wales.

A few miles south-east brought us to Rhuddlan, where at one of the distribution company's showrooms we met Mr. Neale, the No. 1 district engineer, from whom we learned something about the organisation of the undertaking. The whole area of about 2,000 square miles served by the Distribution Company is divided into eight districts, each of which has its own district engineer, with technical and commercial assistants. Each district does its own meter reading and collection, but accounts are sent out from headquarters. In the showroom a cooking demonstration was in progress, and we were glad to hear how well the inhabitants of such a scattered district patronise the demonstrations. From the main sub-station at Rhuddlan 11-kV bulk supplies are afforded to Rhyl and Prestatyn, and also to the Distribution Co. for St. Asaph and Denbigh. There are 106 public lamps in Denbigh—a good example of a street-lighting scheme carried out by the company for various local councils.

The 20-kV double-circuit steel-mast line from Maentwrog to Llanfrothen crossing the Afon Dwyryd estuary, near Portmadoc

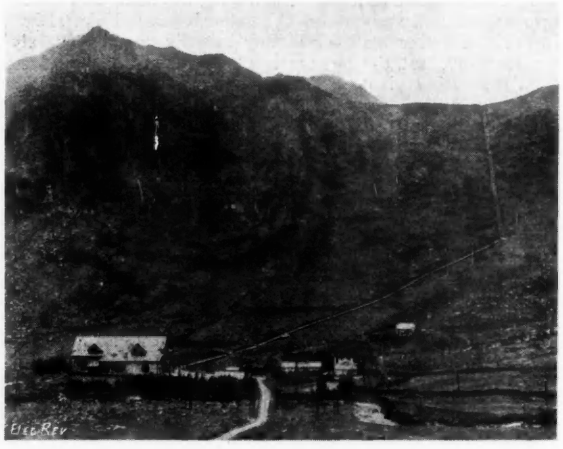
On our way along the coast to Llandudno we passed the quarry of Limestone Products, Ltd., at Abergele, where there is a valuable all-night electricity supply for kiln fans, apart from an extensive use for general purposes; Kinmel School, near Abergele, where electricity is used extensively for cooking

and water heating; the Manchester Corporation's sanatorium, which also provides a considerable load; limestone quarries at Llandulas; and Colwyn Bay, where a duplicate 20-kV bulk supply is afforded the U.D.C. direct from Dolgarrog and also from Dolgarrog *via* Penmaenmawr quarries and Conway. Llandudno, the power company's largest "local authority" consumer, is supplied at 6.6 kV from both Conway and Colwyn Bay, and these three points complete the triangle of an auxiliary "ring" of the transmission system, typical of many such rings outside the main system.

Granite Quarrying

Proceeding to Penmaenmawr we passed through Conway, the first town in North Wales to adopt assisted wiring, and then Penmaenmawr village, where about 95 per cent. of the houses are using electricity. At the quarries of Penmaenmawr and Welsh Granite Co., Ltd., we were compensated for a climb of some 1,500 ft. by seeing a Buchanan crusher, with 54 in. by 72 in. jaws, driven by a 400-h.p. 2,000-V motor, and a Bucyrus navvy, with a 4-cu. yd. bucket, in which individual motors for hoisting, swinging and thrusting are supplied by three d.c. generators all driven on the same shaft by a 250-h.p. 2,000-V, three-phase motor, with an auto-transformer starter, all in the navvy house. Ward Leonard speed control is provided, a separate small motor-generator set providing the resistance-controlled excitation current for the generators.

The navvy moves along the rock face, lifting the material loosened by blasting and transferring it to trucks on rails. The navvy is supplied by a trailing cable specially designed and made for the particularly severe conditions by Messrs. W. T. Glover & Co., Ltd., *via* specially designed oil circuit-breaker-controlled 2,000-V interlocking plugs supplied by Messrs. George Ellison, Ltd. The plugs are served by underground cable through Allen West switchgear from one of the quarry company's four sub-stations on the works operated at 20 kV from Dolgarrog.



The Cwm Dyli hydro-electric station

Nearing Llanfairfechan our attention was drawn to a coastal road improvement scheme, embracing a viaduct and tunnels, for which an 11-kV line from Llanfairfechan and two sub-stations have been erected to serve a "Blondin" aerial ropeway, cranes, and an air-compressor.

The Menai Straits crossing of the 33-kV line from Bangor to Holyhead consists of a 1,550-ft. span of steel-core aluminium conductors carried by 135-ft. steel masts, erected by the J. L. Eve Construction Co., Ltd. At Bethesda we were surprised to learn that over 3,000 h.p. of motors is installed for aerial ropeways, compressors, saw-mills, pumping, &c., in the 200-year-old local Penrhyn slate quarries, where there is modern plant for grinding slate to a fine powder for use as a filler for many purposes. On the way to famed Capel Curig, where we saw some interesting line tappings for village l.p. distribution and hotels, we passed the transmission line from Cwm Dyli to Penrhyn quarries, and saw the Cwm Dyli and Dolgarrog interconnector near Capel Curig, and a few miles south-west from here we obtained an excellent view of the company's first power station at Cwm Dyli (5,500 kW).

Long-lived Wood Poles

Driving through Llanberis Pass, from 1,170 ft. above sea level down to Llanberis, we sought information as to the life of wood poles, and were told that some in a valley to our left had been in service for twenty-five years. These carry the Cwm Dyli to Llanberis, &c., three-circuit 10-kV line. At Dinorwic quarries about 2,700 installed h.p. is provided for by three sub-stations, including a new one at the top which presented serious constructional difficulties.

On the road to Caernarvon we saw the transmitting station of Imperial and International Communications, Ltd., which takes a useful high load factor supply. Caernarvon Corporation takes a bulk supply, and the system has been changed recently from d.c. to a.c. The Power Company's "open" sub-station on the outskirts of Caernarvon, feeding a municipal sub-station in the town, is typical of many supply arrangements of this class and size in the area. Taking the circuitous road to Maentwrog, we passed through Penygroes, where many of the oldest slate quarries are still being worked and are now using electricity, and through Penrhyndeudraeth, where an explosive works is a useful consumer. Near here the 20-kV double-circuit line crosses the estuary of the Afon Dwyryd on two steel masts mounted on concrete bases. This line is tapped on the south side of the river for feeding a new 11-kV line to Harlech and Barmouth.

At Maentwrog power station one of the three Boving-English Electric sets was "down." The tips of the water wheel buckets which had become corroded were being renewed by stainless steel welded on by a portable "Quasi-Arc" set. The supply, generated at 6.6 kV, is controlled by Reyrolle switchgear and stepped-up by Ferranti and English Electric transformers to 20 kV and 35 kV for transmission by the Dolgarrog and Cwm Dyli interconnectors and the western area feeders, and to 66 kV for transmission by the Maentwrog-Legacy line.

Quick Work

Near Blaenau-Ffestiniog the Yale Electric Power Co., a local non-statutory undertaking, receives a bulk supply. The switching station at Corwen is the only "break" (roughly midway) in the 66-kV line. At Minerva we heard of a very smart piece of work. During the drought the Wrexham and East Denbighshire Water Co. called for an electricity supply at very short notice to a new pumping station provided by the 200-ft. deep working of an old lead mine. A three-span 11-kV spur line and a 50-kVA pole transformer were erected and the supply made available in a few days.

West of Wrexham we found supply work, like the country, vastly different from that in North Wales proper; dairy farming and different kinds of factories are here responsible for the major power demands, rather than mineral winning from the earth, and the like. At Marchwiel, near Wrexham, the 33-kV Legacy-Crewe line is being tapped for the village supply, and at Whitchurch we had a glimpse of the No. 7 district showroom which has been awarded first prize on several occasions in an annual inter-company window-dressing competition organised by the British Power & Light Corporation. This district is supplied from the 33-kV Crewe-Oswestry line, which at present is operated at 11 kV. At the Grindley Brook sub-station space is provided for an outdoor 33/11-kV transformer for some future time. There are similar sub-stations at Acton (Nantwich) and Ellesmere, and near at hand is one of several corn mills supplied by the distribution company, and the milk factory of United Dairies (Wholesale), Ltd., where milk from surrounding farms is cooled, pasteurised and bottled for despatch to London. An 11-kV supply is provided by the distribution company for this factory, and also for similar ones at Ellesmere and Calveley. We saw at Wrenbury an 11-kV spur line feeding the patent food works of Trufood, Ltd., which has a secondary tapping for local distribution. From Acton sub-station 11-kV lines radiate into the surrounding rural area in which many large farms and mansions are supplied.

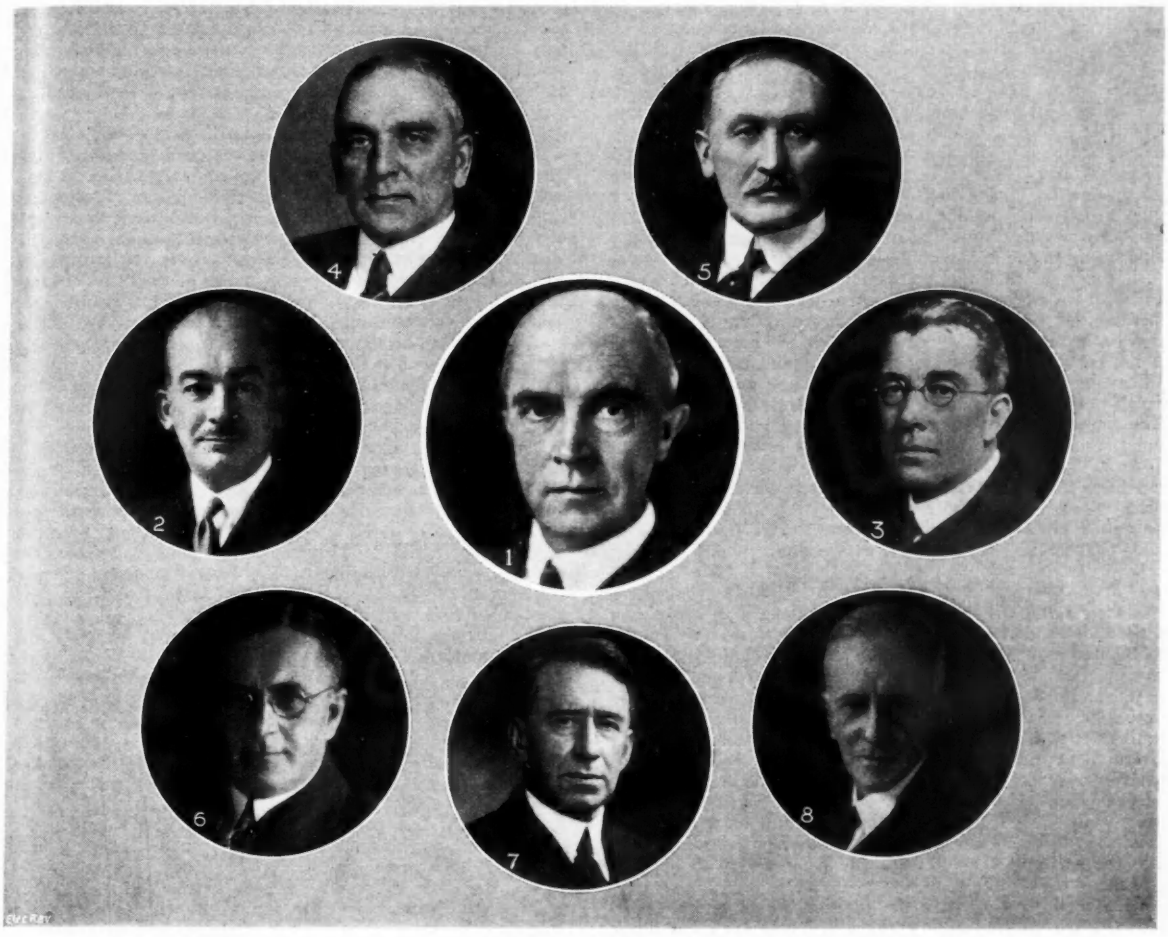
A Railway Works

At the company's Crewe sub-station we saw the 33-kV double-circuit feeders from Legacy and Runcorn, and duplicate 33-kV cables to the company's largest consumer, the L.M.S. Railway Works. There is also an 11-kV line to Sandbach, where are Foden's Wagon Works and the silk mills of Messrs. G. H. Heath & Co., both of which concerns have transferred entirely to the power company's supply within the last two years.

The Central Electricity Board's adjacent sub-station appears to be considerably different from most of the grid structures we have seen. The lack of the usual ironwork, and concrete poles with radiating arms at the top for the lead-down conductors gives an impression of continuity. The grid connection at this point is a loop-in of the 132-kV line from Runcorn to Stoke. The Central Board's switchgear in the power company's sub-station is designed to line up with the existing Reyrolle equipment, and a grid supply will be available on January 1st next.

Our tour concluded with a visit to Church's Mansion at Nantwich, a sixteenth-century building in which candles afford the only interior lighting; but the exterior is electrically flood-lighted. Generally, it seemed to us that there is increasing activity in most of the industries in the area, after a period of acute depression. In this revival electricity, pushed forward by an energetic organisation, is taking a leading part.

Some Driving Forces in the Industry: British Thomson-Houston Co., Ltd.



1. Mr. W. C. Lusk, chairman. 2. Mr. J. L. Wilson, director in charge of sales. 3. Sir Felix Pole, director. 4. Mr. H. N. Sporborg, director in charge of engineering. 5. Mr. F. Fraser, director and secretary. 6. Mr. H. A. Lingard, director in charge of "Mazda" lamp sales. 7. Mr. G. M. Campbell (*Lafayette*), director in charge of manufacturing. 8. Mr. J. Gray, director in charge of patents. (*Photographs Nos. 1, 2, 6, and 8 by International Rotogravure.*)

Earth Connections. By T. C. Gilbert, A.M.I.E.E.

The need for further investigations

EARTH connections fall roughly into two classes: those made to pipes connected with extensive underground water supplies, and those made to artificial electrodes, which usually take the form of driven pipes or rods or buried plates. In some countries other underground piping systems may be utilised—as in Canada and the United States—but in this country the use of pipes conveying inflammable liquid or gas are not permitted.

Connections to underground piping systems are unlikely to give trouble, even if their ohmic resistances appear comparatively high. The heavy current-carrying capacity of such connections will generally ensure that no increase in resistance will occur with the passage of heavy fault currents, whilst the direct conductive path through the earth should prevent the appearance of potential gradients. Troubles arise as soon as any of these ideal forms of earthing connections are not available.

The position is likely to be further complicated in the future, owing to the tendency to employ non-metallic underground water pipes, which practice has now reached—from the electrical engineer's point of view—alarming proportions, in Australia, for instance. The water main as an earthing conductor will in time disappear, and already in many districts it cannot be utilised.

There is a serious lack of precise information regarding artificial earths, and it is difficult to forecast the behaviour of any particular form of electrode owing to the varying factors involved, such as the contact resistance between the conductor and the surrounding soil, and the specific resistance of the soil itself, which again will vary enormously between extremes of dry and wet weather, or heat and cold, so that an electrode which may be adequate to-day may within a few weeks be useless.

The electrical engineer concerned with rural installations is faced with a very involved problem in designing effective earth systems for the protection of his wiring systems and connected equipment. There are three main factors to be taken into account: first, and possibly most important of all, he must secure, and maintain, as low a resistance as circumstances permit; secondly, he must at all costs avoid the appearance of potential gradients upon the earth's surface; thirdly, although really low-resistance artificial earthing electrodes may sometimes be secured at great cost it is usually found that the expenditure has been in vain.

Even extensive systems fail to produce low resistance values. In recent tests made on large steel towers in this country, no data existed for the calculation of their resistances to earth. A tower on the Luton-Watford line was selected for one test, and the structure, together with its associated earth plates, showed a resistance of 4.4 ohms. Most amazing of all, however, was a test on one of the towers of the Thames crossing at Dagenham; the tower is 487 ft. high, weighs 300 tons, and measures 120 ft. square at the base. Each of the four legs is supported on fourteen concrete piles 60 ft. long, and is provided with large earth plates buried in coke. The resistance of the tower alone—that is, of the 56 60-ft. reinforced concrete piles—was found to be 0.11 ohm, whilst the massive earth plates in parallel registered 0.29 ohm. These figures must be taken as exceptionally low, the towers being erected on marshy ground; had the soil been of a rocky or sandy nature the recorded values might have been at least ten times as great, and it is difficult to conceive what steps could then have been taken to reduce this high value in view of the already wide extent of the structure.

The value mentioned above, 4.4 ohms, would be an impossibly high one under certain circumstances, and on standard

distribution pressures would limit leakage currents to about 50 A. This current would fail to isolate a line protected by fuses with any rating in excess of 25 A.

I suggest, therefore, that we can disregard the question of expense and also, at the moment, of potential gradients, as the latter can often be overcome by using several electrodes in parallel, placed in carefully chosen positions. It is not usually realised that an earth plate of high resistance may have a low potential gradient, whilst an earth plate of low resistance may have a high potential gradient, as is pointed out in Messrs. Evershed and Vignoles's publication on earth resistance measurement. This is due to the dependence of the resistance upon two factors, the dimensions of the plate and the specific resistance of the surrounding soil, whilst the potential gradient depends upon one factor only—the dimensions of the plate.

All the time that the isolation of a defective circuit—defective by reason of an earth fault—is dependent upon the operation of the overload devices, necessitating the passage of a comparatively heavy current, then the actual resistance of the earthing electrode must be of paramount importance.

Leaving out of the question impedance and reactance—which would tend to reduce still further fault currents—Ohm's Law shows us that with a supply pressure of 230 V to earth and a circuit protected by fuses rated at 10 A (melting with 20 to 25 A) the total resistance in the earth circuit must be less than 10 ohms under the worst likely conditions. For a circuit protected by fuses rated at 25 A (60 A fusing) the resistance must be less than 4 ohms; with fuses rated at 60 A (100 to 120 A fusing) less than 2 ohms.

Water Systems May be Unsafe

Such low values may reasonably be expected in connection with underground piping systems, if extensive, but cannot be secured by any other means. Even underground water systems must be suspect, if purely local and of small extent, or if laid in sandy soil. In Germany recently, several horses were killed in a cavalry training barracks, although the faulty equipment was earthed to a water system extending over several acres and connected to two deep wells, and about twelve cows were killed by coming within the area of an extensive potential gradient, although nowhere in contact with live metal. This trouble was due to a fault on a cable, the sheathing of which was bonded to a water pipe leading down into the earth in the cowshed, and connected with a water system.

With earthing electrodes the position would appear to be hopeless except under exceptionally favourable conditions; under the Canadian and American Codes the resistance of artificial earthing electrodes is expected to rank as high as 25 ohms (National Electrical Code, 901-e). Where this low value cannot be secured, it is permissible to ignore the Regulation provided that two electrodes spaced 6 ft. apart and 6 ft. from all other electrodes are utilised. Such earthing conditions can only be described as protective by courtesy; far greater safety would probably be ensured by abandoning earthing altogether, as has been done in rural schemes in some areas abroad.

Infallibility of Isolation Essential

The employment of an imperfect earth connection will introduce serious risks that would not otherwise arise. A leakage to the frame of a portable farm motor, if unearthed, would constitute a menace only to those in its immediate vicinity; if connected to a central earthing system this leakage potential would be extended to *all* similarly connected equipment, and some of this sound equipment might be the cause of shock to operatives. In addition, should the same electrode be utilised for the earthing of the outer casing of the wiring system, or, if connected to a second electrode, be so placed that it can come within the area of a potential gradient due to the first electrode, then there is also the likelihood of the extension of the leakage potential to the steel framework of buildings, iron fencings, wire netting and the like.

In rural areas where the neutral line earthing electrode is utilised for the system and equipment earth also, unless this electrode is of extremely low resistance then a similar potential would probably be extended to all connected apparatus and building structures—but under condition of normal operation and *without* faults in existence. In Germany, where the multiple earthing of the neutral has been extensively practised throughout all rural developments, accidents have arisen from this cause time and again. Although the neutral earth resistance, when first installed, might have been workably low, yet the continued passage of current over this electrode, due to unbalanced loads, so common in rural installations, would raise the resistance to a much higher value.

The proposal to introduce multiple earthing into Great Britain, in conjunction with bare neutral wiring, presumably on the score of cheapness, must be fought until the isolation of defective circuits or apparatus can be made more certain than it is now.

The E.R.A. has prepared a useful report concerning the resistance of earthing electrodes, and extracts from this have been published in the *Journal* of the I.E.E. (No. 438, June, 1933). So far it has not been made available to the general body of the industry, which is to be regretted, as the present seems to be the time for all available information on this pressing matter to be made public property, to the end that some more efficient means may be devised.

Cascade-type Transformers for Simultaneous Measurements

THE accompanying illustrations, from *Revue Générale de l'Electricité*, show the principle of a mixed transformer comprising several elements mounted in cascade, permitting the simultaneous measurement of pressure and current in an e.h.p. circuit and effecting a substantial saving of weight and cost compared with ordinary instrument transformers.

Each element of the transformer consists of a three-limbed magnetic core (fig. 1) with the two halves of primary and secondary pressure windings on the outer limbs, and current windings on the central limb. If the outer limbs were electrically and magnetically symmetrical with the centre limb, the current in the pressure windings would produce no flux in the current windings, and *vice versa*. Actually, in a certain case, normal voltage applied to the pressure windings induced 0.6 per cent. of the normal current in the secondary current winding. Such an effect can be neutralised by connecting an appropriate resistance and reactance across the terminals of the pressure secondary. The inductive effect of the current winding on the pressure winding is practically negligible.

Referring to the vector diagram (fig. 2), the shunt winding produces the equal fluxes ϕ_1, ϕ_2, and the series winding produces ϕ_2 (actually less than $\phi_1/15$) in the central core. The resultant fluxes in the lateral cores are ϕ_{R1} and $_{R2}$; and the total secondary pressure is proportional to the sum of ϕ_{R1} and ϕ_{R2}. The indications of V are independent of changes in current; and the indications of A are not influenced by changes in voltage since ϕ_1, ϕ_2 do not affect the central core.

By connecting a number of elements in series, as in fig. 3, a transformer is obtained applicable to e.h.p. circuits. The overall dimensions and the amount of oil required are reduced by placing the limbs of the magnetic circuit at the apices of an equilateral triangle. Full particulars of the characteristics of the new transformer are given by G. Scarpa in *L'Elettrotecnica*. A transformer built for primary pressures and currents of the order of 150 kV, 200 A, would measure about 3 ft. 3 in. by 2 ft. 9 in. by 7 ft. With no secondary burden, the error in pressure measurement is about 0.4 per cent. in ratio and −14′ phase error; with a load of 30 VA, 0.6 p.f., these errors become about −0.5 per cent. and −20′ respectively. As the magnetisation of the transformer is mainly supplied by the pressure windings, the errors in current measurement are lower the higher the primary voltage. In order that the transformer may be put out of action, a switch must be used which first short-circuits the primary terminals.

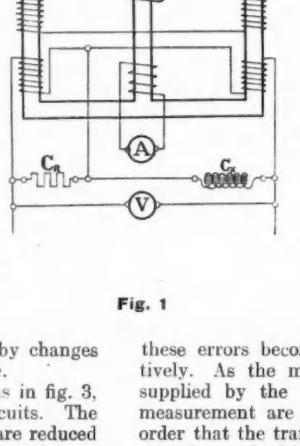


Fig. 1

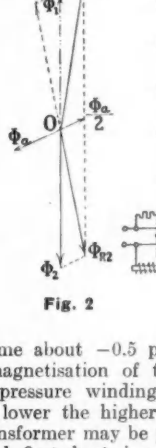


Fig. 2

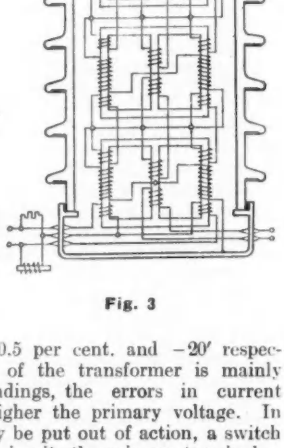


Fig. 3

Chokes and Condensers. By E. V. Clark, B.Sc., M.Inst.C.E., A.M.I.E.E.

THE ELECTRICAL REVIEW of June 23rd, containing an article entitled "Applications of Resonance," by Mr. G. W. Preston, A.M.I.E.E., arrived in Australia very opportunely, in that I had at the very moment a student in Adelaide University engaged upon experiments on resonance between choking coils and condensers, such as are described by Mr. Preston, investigating the conditions of instability that theory predicted. Mr. Preston's approach to the subject is on the side of practical utility. Mine is rather the academic one of devising interesting experiments that will bring home to students the properties of alternating currents, and of illustrating the degree that theory, admittedly not quite accurate, will be confirmed by experiment in cases in which the predictions of theory are, to say the least, somewhat surprising.

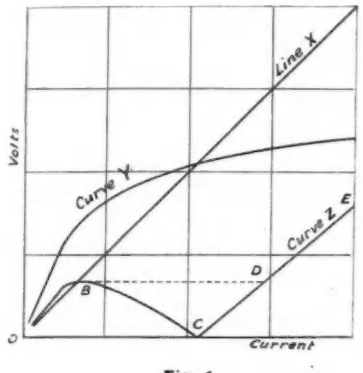


Fig. 1

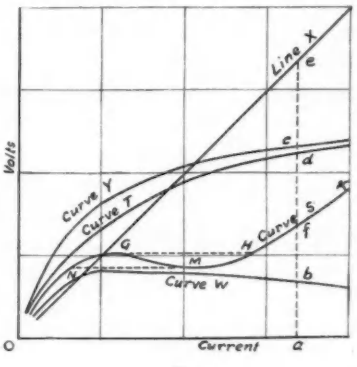


Fig. 2

If in fig. 1 the straight line X represents the relation of voltage to current in a condenser at given frequency, and the curve Y that in a choking coil with iron core at the same frequency, then as the capacity current leads the voltage across the condenser by 90 deg., if we make the (erroneous) assumption that the choking coil current is both sinusoidal and lagging by 90 deg., and it follows that the necessary voltage to send current through condenser and choking coil in series must be the difference between these two curves, or that shown by curve Z. This represents a voltage falling to zero at the point C, the voltage leading the current by 90 deg. over the loop OBC, and lagging by 90 deg. in the part CDE.

If, in a circuit consisting of an ideal alternator in series with this condenser and choking coil, we gradually raised the excitation, at constant speed of revolution, the current would follow the arc ABC as far as its highest point B, and then suddenly jump to the point D, thereafter following the curve on to E. On lowering the excitation, the current would follow the curve EDC, still giving the current represented by OC when the voltage had practically vanished.

Theory and Practice

Unfortunately, these are conditions that cannot be realised in practice. In the first place, no iron-cored choking coil takes current lagging by 90 deg. on account of hysteresis; and, even though we could obtain a variety of iron entirely devoid of this loss, the very fact that the magnetising current of the iron is not a straight line (the fact upon which the experiment is based) means the introduction of harmonics, which must remain to give some voltage, no matter how close the resonance between the condenser and the choking coil. In the second place, the alternator used in the test cannot be ideal, but has its own limitations. In particular, if a small alternator is used, there must be an appreciable rise in voltage from B to D without change in the exciting current, since at B we have a lagging and demagnetising current flowing in the armature, and at D a leading and magnetising one.

We may obtain a closer approximation to a true state of affairs if, when obtaining the magnetising current of the choking coil, we include a wattmeter and determine the curve of power factor. We may then divide the magnetising curve OY into two portions (fig. 2), OW being the power component of voltage, and OT the wattless component, so that at any point $ab^2=ac^2-ad^2$. We may now regard OT as being a curve connecting current with the sinusoidal quadrature component of voltage, which is capable of being entirely neutralised by the voltage across the condenser, with a fair approximation to truth; but there still remains one error, in that the rule: total voltage=root of power component squared plus quadrature component squared, is true only for sinusoidal waves; and that when harmonics are present, as in this case, the apparent quadrature component is really a combined effect of true quadrature component and harmonics.

Ignoring this inaccuracy, we may now proceed as follows:—With current Oa, lagging voltage across the condenser is ae, and leading voltage across the choking coil is ad, so that de is the net quadrature component of voltage, whilst ab is the power component. If then we compute and plot $af=\sqrt{(ab^2+de^2)}$, we now have the requisite voltage to produce current Oa. Proceeding this way, we may compute and plot the whole curve connecting current and voltage; and if condenser and choking coil be appropriately chosen, this will be of the form shown as curve S in fig. 2.

If we connect this circuit to an ideal alternator, and steadily increase the excitation, current will rise gradually to G, then jump suddenly to H, and continue steadily to K; and on reducing excitation, current will fall steadily from K past H to M, and then drop sharply to N. This curve agrees with that shown in fig. 4 of Mr. Preston's paper, save that no hint is there given that there may be some marked difference between the ascending and descending curves. The separation of these depends on there being a maximum and minimum in the fundamental curve of current and voltage in this circuit. By a suitable choice of materials one might make the width of the loop very small, but probably at the expense of diminishing its length also.

Effect of Ignoring Harmonics

In fig. 3 are curves obtained from an actual test of this kind, the condenser being of 96 mF, the choking coil taking about 10 A at 200 V 50 cycles, and the circuit being fed from a 12.5-kVA alternator. With rising excitation, current became unstable at 1.44 A, jumping thence to 7.7 A, the alternator voltage increasing from 74 to 109, with little change of exciting current, owing to the magnetising effect of the current taken. With descending excitation, current was reduced to 5.9 A, and voltage to 73, before instability was reached; and readings then fell to 0.86 A and 61 V.

By the method described above and illustrated in fig. 2, the approximate relation of current and voltage in the circuit was computed from power-factor measurements made on the choking coil, and the circles in fig. 3 show the points on the curve as calculated. They represent a curve of the proper form, reaching the maximum of 84 V at 2.5 A and the minimum of 63.5 V at 5.75 A; but they do not agree with the experimental curve very well, and in particular give appreciably lower voltages with high currents. The discrepancy in the upper region may be attributed to the error introduced by ignoring harmonics in the calculations (as mentioned above), being in the right direction for this, and requiring harmonics of peak value about 25 per cent. of the fundamental to bring the calculated points on to the test curve. In the lower region, where the errors are in the wrong direction for this,

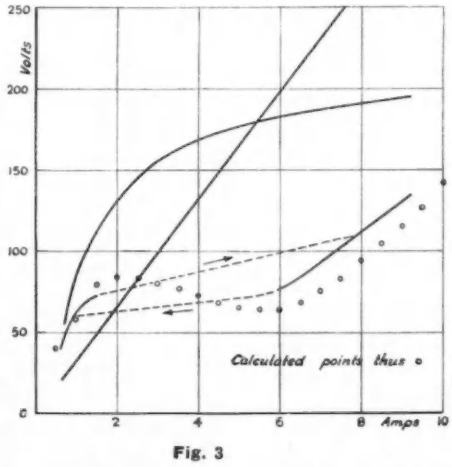


Fig. 3

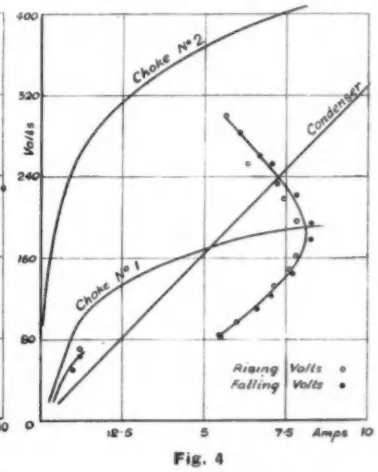


Fig. 4

the discrepancy is probably due in part to the fact that the alternator at this stage was on a very steep part of its excitation curve, so that the critical point could not be fixed with absolute precision, and partly because at low flux densities in the choking coil the instrumental errors in the power-factor measurements were considerable.

The circuit consisting of a choking coil in series with a paralleled condenser and second choking coil, described by Mr. Preston and illustrated in his fig. 5, is very ingenious. Fig. 4, herewith, gives the results of a test carried out with this circuit, using three voltmeters and three ammeters to elucidate matters. Choke No. 2 and condenser curves are obtained from the ammeters in their respective circuits and the voltmeter across them, and that of choke No. 1 from the voltmeter across its terminals and the main current. The curve connecting main current with voltage across the complete circuit reaches an early point of instability, and indicates a voltage maximum of about 75 V at 2 A and a minimum at about 4 A. A current maximum of 8 A is reached at 175 V and a minimum of about 5 A would probably have been met with in the neighbourhood of 350 V, had facilities allowed of the curve being continued higher.

The explanation of the shape of this curve lies in the fact that parallel circuits and series circuits are in many respects the converse of one another. As a choking coil and condenser in series may have a stage where rising current means falling voltage, so a choking coil and condenser in parallel may have a stage where rising voltage means falling currents; and it only needs that the two circuits be combined in such a way that the parallel choking coil takes negligible current at the time when the condenser and series choking coil give resonance effects to produce this curve.

Measuring the Power

In any experiments of this kind, the phase of the current changes rapidly from lagging to leading or vice versa at the position of instability. An attempt to show this by including a wattmeter in the circuit was a failure, since at time of least wattless component of current, the harmonics are most pronounced, and it is impossible to obtain a power factor of unity.

A curve of power factor consequently does not suggest the change of phase. The best mode of approach for showing this result would be to arrange the circuits in three phase balanced form. The change of phase of current from leading to lagging might then be rendered quite visible either by an indicating phase meter or by the two-wattmeter method of measuring power, since despite the presence of harmonics equality of wattmeter readings indicates conditions when the current is almost exactly in phase with the voltage; and by observing which wattmeter reads the higher one may at once tell whether current is leading or lagging, excepting only if readings are almost the same.

Plotting Current-voltage Curves

If it is desired to trace out the full path of the current-voltage curves of figs. 3 and 4, including the unstable portion, this may readily be done by feeding the circuit from constant pressure mains, and cutting the voltage down by series or potentiometer type rheostat. A better plan, however, is to supply from an independent alternator as before, but to include a rheostat of about 15 ohms resistance in the circuit. With resistance cut out the unstable condition is met; but directly it is inserted instability is removed, and the curve may be plotted point by point throughout this zone by increasing the alternator excitation. Subsequent readings are best taken by cutting out the rheostat in steps until it is all removed, and then further increasing the alternator excitation. In tracing the curve in the reverse direction, care must be taken that the rheostat is in circuit before the region of instability is reached.

One word of warning is perhaps desirable. Whenever resonance occurs, one may expect to find abnormal pressure rises; and this is so in the present instance. In the experiment illustrated in fig. 4, though the alternator used was rated at 240 V, its voltage was readily raised to 300, owing to the leading current taken by the circuit; and pressure across the condenser and parallel choke then exceeded 400 V. Where, as in the writer's laboratory, most experimental work is purposely carried out at low voltage, so that exposed terminals on portable instruments, etc., may be used without any risk to students, it is important to see that special precautions are taken in any work where dangerous voltage rises may occur.

Fire Alarm Equipment

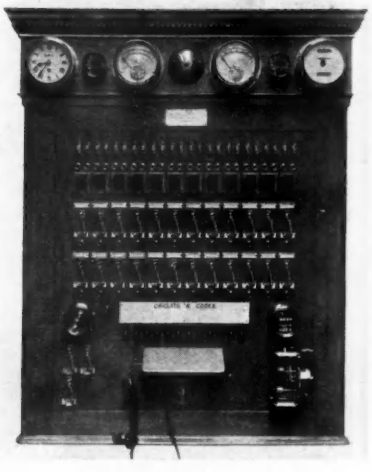
THE "Moore & Knight" fire alarm, police and ambulance call system of Walter's Electrical Manufacturing Co., Ltd., comprises receiving and control equipment with the necessary battery installed at the fire station, whence radiate call circuits, each consisting of two lines or a pair in a P.O. underground cable. More than twelve circuits are rarely required, even in large towns, as any number of street alarm points may be connected in series on each circuit, each pair of lines being joined through a high resistance end hose. Additional lines can be run out from the nearest call point without going right back to the fire station.

An alarm post with transmitter

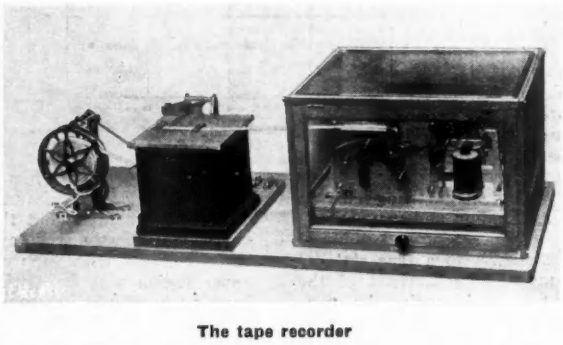
Once the protecting glass is broken and the handle pulled, no further manipulation can affect the signal. The pull trips a trigger that sets a clockwork transmitter in motion; this first sends a regular intermittent warning to the fire station, followed by a code call. The intermittent-signal indicates the circuit of origin and the code identifies the particular street box concerned. The transmitter repeats both signals, which are received by bell and also recorded on tape by a machine which prints the date, hour, and minute of the call.

The alarm is thus given by obvious and simple means. Confusion and delay due to the intervention of an exchange operator, use of the telephone or spoken word are avoided. Nevertheless, the street box is fitted with a telephone, either of the locked door type or the automatic door pattern, which will not open until the alarm has been completed in the first instance by pulling the handle.

Should more than one alarm be given simultaneously, that originating nearest to the fire station will take priority followed by the second, third, etc., in sequence. Electrical circuit faults will ring the alarm bell and so reveal themselves, but will not give the correct code signal to which alone the brigade responds. The defective line can then be switched out, but the circuit will continue to function because each pair of lines is in parellel with an earth return.



The station board



The tape recorder

The street box clockwork transmitter needs rewinding after an alarm has been given. This must be done before the door can be reclosed when a new protecting glass is inserted.

This system is in use at Leicester, Ipswich, Wolverhampton, Brighton, Willenhall, Luton, Grangetown, Eastbourne, and around London at Ilford, Sidcup, Bexley, Friern Barnet, Wembley, Twickenham, Maldens and Coombe, Watford and Southall Norwood. It has also been installed by the Durban Corporation in South Africa and by the Buenos Ayres and Pacific Railway Co., Ltd., in Argentina.

Small Electrically Equipped Houses

A notable scheme at Surbiton

WE regard the houses being erected by Trustees and General Management, Ltd., and constructed under contract, at the new Parkside Estate, Surbiton—some of which are already completed and occupied and some of which are in course of construction—as an important electrical development; first because they represent co-operation between the electrical industry and the speculation building owner, resulting in the saving in building costs, by virtue of the absence of chimneys, this saving being spent on electrical equipment; and secondly, because they are a real and early attempt to introduce a small (three bedrooms, and under £1,000 freehold) house which is practically " all-electric " and designed and constructed as such.

The equipment of the Parkside dwellings falls short of the " all-electric " ideal, for there is one coal fire in each house; but every other room in each house, including the bathroom, kitchen and also the hall, is permanently equipped with electric heating, and in each house cooking, refrigeration, clothes-washing and water-heating services are all arranged electrically. Water-heating can be effected wholly electrically or by the joint coal and electric system, the immersion-heater equipped tanks being also served by a concealed boiler in conjunction with the one coal fire referred to.

There are a few different types and sizes of houses on the estate, but because the equipment of any pair of houses is similar, and because the actual dimensions of corresponding rooms in the different-sized houses vary so little, it will be sufficient to refer in detail to one type of house only. Type A house, which is sold at £880 freehold, has a frontage of 23 ft. 6 in., and its general outlay of three bedrooms, two reception rooms, a bathroom, &c., follow more or less conventional lines.

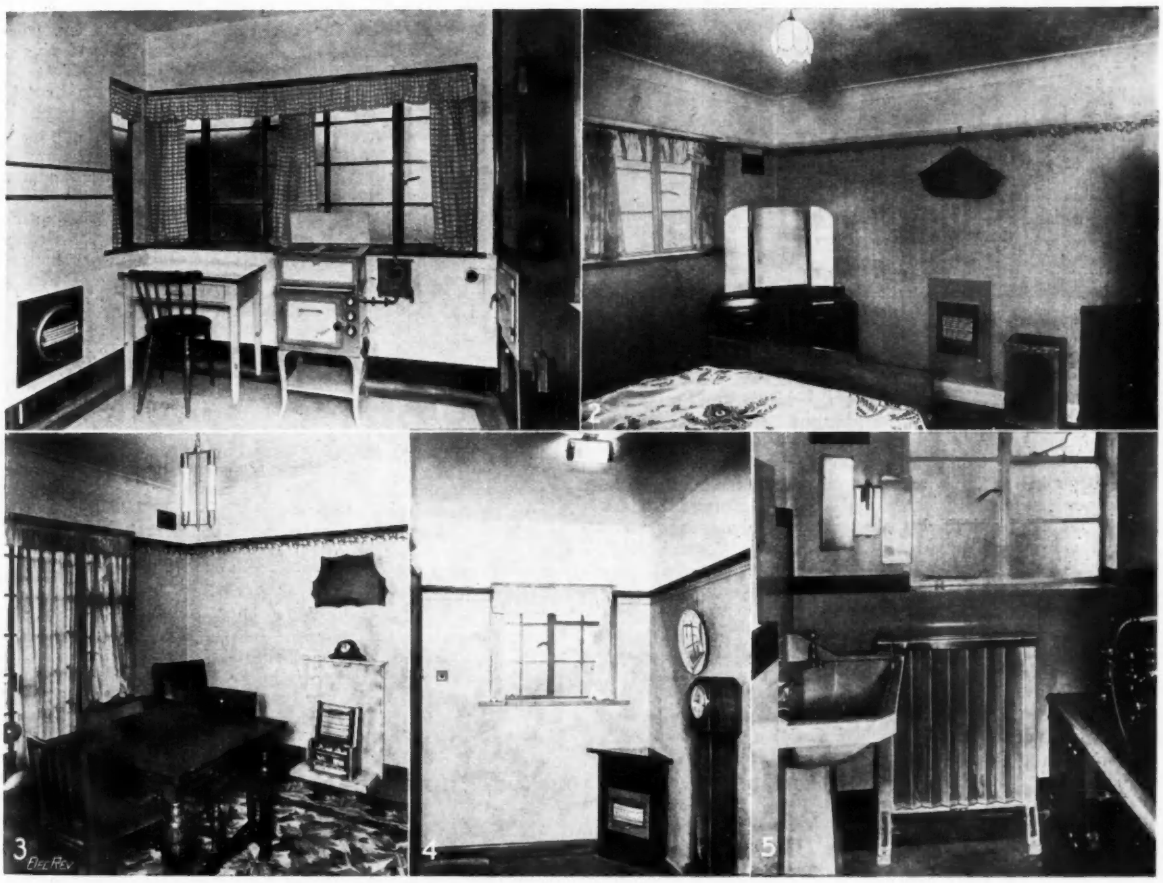
The architect, Mr. R. A. C. Churchward, told us that a saving by the elimination of fireplaces, fires and chimneys of £70 was effected, and that the cost of the whole of the electrical equipment, excluding lighting, was £54. The two larger bedrooms measure about 14 ft. by 11 ft. 9 in. and 12 ft. by 11 ft. 9 in., respectively, and each is equipped with a 2-kW fire, that in the larger bedroom being of the portable imitation-fuel type and having a permanent slab back and hearth setting, while that in the second bedroom is a panel fire with permanent wall fixing. The third bedroom measures about 10 ft. 3 in. by 9 ft., and is equipped with a permanently fixed 1-kW panel fire. In the bathroom there is a combined air-type towel rail and radiator with 350-W loading.

The 25-gallon hot-water tank was specially constructed for these houses, and it is equipped with 2 kW of immersion heaters with thermostatic control. In the hall downstairs we were impressed by the neat arrangement for housing the 1-kW inset fire. It is carried in an angle structure in a corner opposite the door. In other houses the corresponding fire is a wall fixing. The one coal fire is in the larger reception room, while in the other similar room there is a 2-kW imitation-fuel fire with a setting similar to that in the larger bathroom, but perhaps a little more elaborate.

In addition to cooking, heating and wash-boiling equipment in the kitchen there is a 1-cu. ft. air-cooled " Electrolux " refrigerator housed in a recess. The Jackson " 91J " cooker is controlled by a Crabtree unit with an auxiliary plug. The 10-gallon wash-boiler is loaded at 3 kW, and near the door there is a 1-kW circular panel-type fire. This room measures 10 ft. 3 in. by 9 ft. 8 in., and the average height of all the rooms is about 10 ft.

With the exception of lighting and the other equipment already named, the whole of the electrical apparatus was supplied by Berry's Electric, Ltd., to whom we understand credit should largely be given for the development from the electrical point of view.

Electricity is supplied to the estate by the London and Home Counties J.E.A., under a two-part tariff with a fixed charge based on floor area, varying from £2 per annum for 800 sq. ft. to £3 10s. 6d. per annum for 1,500 sq. ft., and a running charge of ½d. per kWh for the summer quarters and ¾d. per kWh for the winter quarters. The fixed charge for the actual type of house referred to is £2 10s. per annum (937 sq. ft.). We learn that eighty of the houses have been sold since the estate was started in September this year.



Houses Built as Electric Homes at Surbiton

1. A kitchen with cooker, built-in fire and refrigerator (right). 2. One of the bedrooms. 3. Dining room with modern lighting fittings and a " Magicoal " fire. 4. An entrance hall. 5. Bathroom with electrically heated towel rail; the mirrors flanking the lighting fitting are adjustable

The Overhead Lines Association

THE sixth annual conversazione and supper-dance of the Overhead Lines Association was held at Harrod's Georgian Restaurant on November 17th. About 200 members and guests were received by Major T. Rich, this year's president, and quite clearly enjoyed the evening.

As on previous occasions, the opportunity was taken by many manufacturers to display equipment related to overhead line transmission, and its association with rural electrification. Thus, British Ropes, Ltd., showed a representative selection of tension clamps and joints and stranded conductors, and Bullers, Ltd., a variety of insulators, including an interlinked suspension type for high voltages. Castings in malleable and

A Pirelli-General telephone type catenary cable in a country lane

grey iron for all kinds of electrical work were seen on the stand of Court Works, Ltd., and the many applications of "Pernax," including cable sheathing, on that of the Croydon Cable Works, Ltd.

Photographs by Drake & Gorham, Ltd., showed how their tandem-coupled switches can be used with outdoor structures of different kinds. A neat model of an "Empire" 33-kV 200-A pull-down fuse-switch with compensated balance provided the main feature of the exhibit of Electric Control, Ltd., which also displayed 132-kV fuses with rupturing capacities up to 500,000 kVA. The "Megger," the "Meg," and the "Wee-Meg" shown by Eversheds & Vignoles, Ltd., need no introduction to our readers. Near by, Ferguson, Pailin & Co. had laid out examples of their 11-kV isolators and fuse isolators, an E.O. lift-out fuse and a 60-A 11-kV fuse as an indication of their products in this sphere.

The exhibit that seemed to attract most general attention (as it appealed also to the non-technical half of the visitors) was the working model of a surge generator and surge absorber of Ferranti, Ltd., who also displayed a house-service lightning arrestor, an automatic voltage regulator motor of the induction disc type, a solderless transformer terminal, and a safe-load indicator. The farming aspect was the one chosen by the General Electric Co., Ltd., which had on view a 150-chick radiant hover, a "Magnet" soil-heating cable, a 4-kW sterilising chest, an egg-tester, tubular heaters for greenhouses, a 5-h.p. "Drumotor," and 5- and 2-h.p. skid motors for star-delta and direct starting respectively.

In addition to photographs of well-known sub-stations, the metalwork of which is protected with "Ferrodor" and "Vitros" paints, Griffiths Bros., Ltd., demonstrated a simple test for scale formation before applying the coatings "Pyrex" radio insulators with a dielectric strength of 35 kV per 100 mil. thickness and low coefficient of expansion were shown by James A. Jobling & Co., Ltd.

A Variety of Rural Electrification Equipment

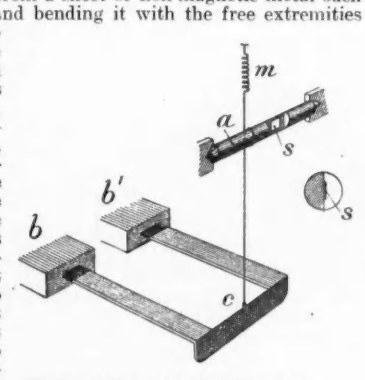
The largest area occupied by an exhibit was that in which Johnson & Phillips, Ltd., displayed a comprehensive selection of apparatus for rural electrification schemes. This included "Wonpeace" brown glazed porcelain insulators for services, the "Juno" bracket for l.v. lines, 11-kV and l.v. pole-mounting trifurcating boxes, 30-A 250-V double- and single-pole cut-outs, a 20-kVA single-phase 10,500/230-V pole-mounting transformer, and an 11-kV drop-out switch-fuse (with a fuse of the expulsion type, breaking circuit at 15 per cent. maintained overload, and having a rupturing capacity of 100,000 kVA). The feature that drew the eye was a working pole-mounting 11-kV circuit-breaker which automatically recloses three times in succession with adjustable time-lag. Two other items were the 100-A l.v. pole-mounting switches and an 11-kV horn-break switch for sectionalising. Photographs of the Isle of Man scheme and of work for the C.E.B. were also shown.

A new "Klydonograph" was an attractive feature on the stand of the Metropolitan-Vickers Electrical Co., Ltd. This continuously records both positive and negative surges on standard 35-mm. cinema film in 100 ft. lengths and automatically records the time. Other exhibits were a 50-A, 11-kV fuse isolator, and an 11-kV oil circuit-breaker with mechanical auto-reclosing for four openings.

Pirelli-General Cable Works, Ltd., showed a scale model of a wood pole with a top fitting (constructed of a single length of channel) which eliminates the need for bird-guards, an 11-kV catenary cable, an armoured pilot and telephone earth-conductor aerial cable, and several photographs of overhead lines. Various grades of oil suitable for electrical purposes were on the stand of Silvertown Lubricants, Ltd. Switchgear & Equipment, Ltd., displayed a variety of gear, which included a 33-kV rotating isolator, 11-kV switchgear, a l.v. combined strain-type insulator and fuse, and carbon-tetrachloride fuses up to 500,000-kVA rupturing capacity for 33- and 66-kV systems. The Yorkshire Switchgear & Engineering Co., Ltd., showed a pole-type dividing box-fuse unit, push-pull air-break switchgear, and the "Yorkshire" cut-out—a combined service fuse and porcelain end strain intended for fixing to a pole or cross-arm as a make-off insulator.

A Three-phase Oscillograph Wattmeter

IN a recent publication of the Associazione Elettrotechnica Italiana, Prof. G. Sartori, Director of the School of Engineering at Bologna, describes an instrument of the oscillographic type which records on a sensitised chart—and with an approximate accuracy—the graph of the power supplied to or absorbed by an apparatus using d.c. of single- or three-phase a.c. By cutting a U strip from a sheet or non-magnetic metal such as phosphor-bronze, and bending it with the free extremities anchored in blocks *b* and *b*', and with the third side, *c*, inserted between the poles of an electromagnet, a form of oscillograph is produced, such that when a variable current is made to pass through the coil, it will oscillate with displacements proportional to the intensity of the current passing. The two parallel sides will not remain rectilineal, but become deformed into an elastic curve corresponding to the oscillation of the third side, *c*; not even when the oscillation falls as low as a fraction of a millimetre can the other two sides continue rectilineal.



The arrangement of the system

The author details a method and apparatus for the study of the amplification of the displacement. A metal ribbon, such as is used in galvanometer suspension, is secured at one end to the transverse side of the vibrating system *c* and the other end is secured to a spring *m* and wound once about a rod *a*, pivoted as shown. In an incision in this rod is mounted a small mirror *s* in the axial plane. Supposing the point *c* to execute an excursion of 1/10 mm., and the diameter whereon the ribbon is wound is 1 mm., the rod executes a corresponding rotation; the circumference of the rod being 3.14 mm., the arc of rotation is shown to be 11 deg. One rotation is more than sufficient, because the ray reflected on the sensitive paper will be displaced 40 mm., if the latter is a distance of 40 cm. On the paper will thus be recorded, magnified 400 times, the maximum excursion the point *c* undergoes under the effect of the e.m.f.

The requirements that the vibrating system should satisfy include an appropriate quenching and a suitable characteristic oscillation period. A drop of oil of suitable density for quenching the U coil of the wattmeter can be dropped within the interpolar space within which the side *c* oscillates. Prof. Sartori has made an extensive elaboration of this aspect of the problem for single- and three-phase systems and his ideas may well lead to far-reaching developments in electrical investigational work.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Telephone Interference

THE paper on recent investigations on telephone interference, by Mr. W. G. Radley and Dr. S. Whitehead, which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 23rd, describes the results obtained under the ægis of the British Electrical and Allied Industries Research Association since Mr. Radley read a paper on this subject two years ago.

Although further study of certain aspects is still needed, experiment has decided the relative losses caused by disturbing currents of different frequencies in the telephone line, although their additive law in the case of a complex noise is not certain. A simple quadratic law has been taken provisionally, so that any noise disturbance may be expressed in terms of an equivalent e.m.f. at 800 cycles per sec. This may either be calculated or measured directly by apparatus already developed. In the same way consideration of their disturbing effects gives rise to the definition of a telephone interference factor for electrical machines, as the equivalent disturbing e.m.f., or current, at 800 cycles per sec. expressed as a percentage of the total output. Modern equipment can usually be kept within a t.i.e. of 0.5 or 1 per cent. by suitable design or the use of auxiliary apparatus.

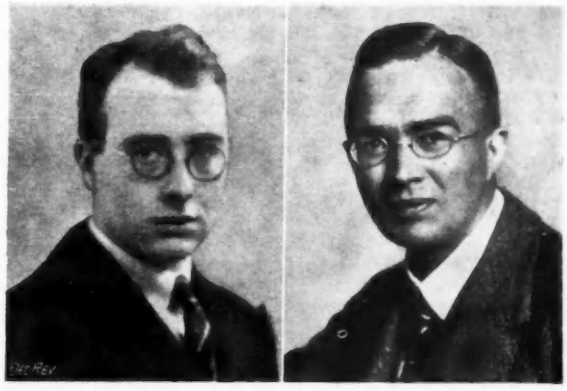
Disturbance from a.c. systems is usually due to earth currents, particularly multiples of the 3rd harmonic. Earthing the neutral may increase or decrease the earth currents, but a system with every neutral directly earthed does not necessarily give large neutral currents; in fact, in the most important case tested such a system gave small currents. On cable systems, resonance may magnify the disturbance due to a particular harmonic.

The Calculation of Induced E.M.F.'s

If the earth current is known, the Carson-Pollaczek theory—the validity of which has been established by field measurements—may be applied to calculate the induced e.m.f.s in any neighbouring communication circuit. Allowance must, however, be made for screening due to the presence of an earth wire or cable sheaths. Formulæ for the screening factor are given in the paper. Its value varies from 0.65 to 0.95 for earth wires. For cable sheaths it decreases rapidly with frequency, so that, when either the power or the communication circuit is contained in a cable, disturbance is greatly reduced. In telephone circuits the actual noise is a function of the unbalance of the circuit: the exact relationship still remains to be determined statistically.

The application of theory demands a knowledge of the local resistivity of the earth. This may be found by induction tests with actual or model circuits, but may also be measured more cheaply and easily by the search-coil method, when a source of earth current already exists, or by a four-electrode resistivity survey where no existing facilities are available. The same principles apply to induction from traction systems, except that all the currents are residuals. The rails give a screening effect depending on the construction and bonding. In Great Britain it is between 0.2 and 0.4 for double-track railways, but will be greater for tramways. The main cases of interference arise from mercury-arc rectifiers, which give large 6th, 12th, 18th, and 24th harmonics. These may be satisfactorily suppressed by the use of resonant filter circuits across the output.

Danger arises from induction due to large transitory earth currents during short-circuits. The shortness of duration will, at least, not increase the induction to an important extent, and the Carson-Pollaczek theory may be used with screening effects allowed for as already described. In the case of earth wires, power-cable sheaths, unarmoured telephone cables, and well-bonded rails, the screening effect is not materially altered by the intensity of the current. Circuits running along a railway track are shielded to some extent from induction from an outside source. The risk is that of electric and acoustic shock. The latter only may be alleviated in part by the use of protective devices.



Elliott & Fry

Dr. S. Whitehead and Mr. W. G. Radley who presented the E.R.A. report on telephone interference at last week's I.E.E. meeting

Avoidance of Interference

Interference may be decreased by the suitable choice of generators and transformers, neutral impedances and filters, output filters, additional earth wires, the use of power cables or telephone cables instead of overhead circuits, the design of cable sheaths, the balancing of communication circuits, the choice of earthing methods, &c. The decision as to the appropriate method rests upon many considerations of cost, practicability, and convenience, which must be determined by agreement for specific cases. Information will be found in this paper as to how the interference may be predetermined for given systems so that the merits of the various possible alternatives can be quantitatively compared, while, at the same time, the possibility of interference in connection with a projected system can be found beforehand.

Heat Liberation and Transmission in Steam Boilers

THE heavier demands and exacting guarantees of performance which have accompanied recent developments in steam-raising plant have necessitated closer inquiry into the fundamental principles on which their performance depends.

These slate quarries at Penrhyn provide a good load for the North Wales Power Co. (See page 727)

Messrs. E. W. Robey and W. F. Harlow present their views on certain aspects of this subject in a paper which was read before the INSTITUTION OF MECHANICAL ENGINEERS in London on November 17th. The full significance of the secondary combustion air which is admitted to chain-grate boiler furnaces does not appear to be generally appreciated. It is necessary to inject secondary air above the grate, preferably into the distillation zone at the front of the stoker, so that it not only provides oxygen for the early combustion of the volatile gases, but also, by creating turbulence, renders available for combustion the inevitable amount of adventitious air entering from the rear of the grate. Few boiler-makers or operators seem to appreciate the volume of secondary air that may be used, and that it must be impelled into the regions from which the combustible gases are rising. The time required for the air and gases to diffuse together governs flame length.

The authors find that, given a suitable arrangement, as much as 40 per cent. of the combustion air can be introduced above the fire without using any greater excess of air than was previously necessary; in fact with installations equipped in this manner it has been possible to operate with a lower margin, as has been indicated by an increase in the CO_2 content up to 16 per cent. at the boiler outlet. This result is possibly due to the decrease in adventitious air, owing to the lower under-grate pressure necessary to pass the decreased volume against the resistance of the grate and the fuel. It is also found that when this method of operation has been applied to large combustion chambers the upper part is redundant and the flames which without secondary air had

extended into the boiler passes and beyond, become shortened.

The effect of injecting the air on all sides would be to create intense turbulence above the fire bed and to prevent the flames from impinging on the furnace walls. In any case it has been found possible, with adequate secondary air properly applied, to use fuel beds of a depth more than double that hitherto considered the maximum. Thus efficient secondary air admission would appear to render unnecessary the large furnaces used to-day and would permit of much thicker fuel beds than have been previously adopted as a basis of stoker design. Hence the width of stokers may be proportionately reduced, permitting the use of narrower boilers. This would in turn permit of much higher gas velocities being adopted in the convection tubes of the boiler and superheater, which would have an important influence on the heating surface required.

It would seem, therefore, that closer observance of the principles of the process of heat liberation expounded by the authors should lead to an advance in speed of operation, together with a reduction of size and cost of the stoker and furnace, minimisation of smoke emission, and reduction of size of boiler.

It also appears from the authors' investigations that the possibilities of reducing the heating surface, and therefore the capital cost, of water-tube boilers by using higher gas speeds, which are made possible by the introduction of mechanical draught, have not been fully explored and that considerable advances are possible in this direction.

Clearing the Air

THE interference of electrical plant with the reception of radio broadcasting is dealt with in a paper, by Mr. A. Morris, which was read in London on November 22nd before the WIRELESS SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS. Different kinds of interference caused by various types of electrical plant are defined, while technical particulars and the principles underlying the design of suppressors for application at the source of interference and of other ameliorative devices for incorporation in the receiver are outlined.

Laws and decrees which have been enacted in certain countries tend to place responsibility for the avoidance of interference upon the user of electrical plant, and the International Telegraphic Union and the International Electrotechnical Commission have both recommended that steps be taken to render electrical plant free from the possibility of causing interference. An I.E.E. Committee is now studying the subject with a view to issuing recommendations, and the Post Office is affording licensees much assistance. But it has no statutory power to compel owners of offending plant to suppress interference, the main and usual difficulty being the incidence of cost.

It has been computed that the incorporation of suppressors during the manufacturing stage in domestic and small commercial plant would increase the retail price of the appliance by from one to eight shillings; in a few instances redesign of the appliance would be beneficial. With regard to large commercial plant, a manufacturing cost of from 5s. to £2 per coil would apply to 600 mH chokes suitable for currents of from 5 to 50 A. For the suppression of the audio-frequency harmonics up to and including the 24th of mercury arc rectifier systems the retail price per kW is from 6s. to 5s. for rectifiers of from 1,000 to 2,500 kW. A pair of choke coils for trolley buses with starting currents of the order of 300 A costs from £12 to £16.

The amount of radio interference is becoming greater and its distribution more widespread. The fundamental technique of the subject is relatively simple; the problem is not primarily electrical, but the reconciliation of the economic aspects of the various interests.

Aviation Lighting

THE history and probable future development of aviation lighting are dealt with in a paper by Major R. H. S. Mealing which was read before the ILLUMINATING ENGINEERING SOCIETY in London on November 14th.

Beacons of the searchlight or marine lighthouse type are useless for airway lighting as an aid to navigation. The angle of light distribution in the vertical plane should be continuous from the horizontal to the zenith. The horizontal part of the beam, which is of greatest intensity, enables the beacon to be seen at a great range, while the vertical part of the beam, which is less intense, can be seen at short range (if not when actually over it) when visibility is bad.

For Empire routes where visibility is mostly good one can rely on longe range beacons whose light distribution is concentrated at high intensity in a small angle just above the horizontal. For identification each single-flash white beacon has a small short-range red light on top.

Such obstructions as tall masts should be illuminated at night with fixed red lights, of which one must be at the top and the number and situation of the others according to the height of the obstruction above ground. Major Mealing does not believe that electric grid towers constitute so great a danger as some people suggest. An aerodrome identification beacon should be red in colour and possess a code character consisting of a single Morse letter which must not be repeated within one hundred miles.

Whereas the neon tube lends itself admirably for use as an aerodrome beacon, it possesses no better fog-penetrating power than a white light passed through a red filter emitting the same hue wavelength. The pilot having been led to his aerodrome of destination by the beacons requires to know the precise size and shape of the landing area. This information he obtains from the boundary lights, whose function is to outline by night just as clearly as a fence, hedge, or artificial markings will do by day, the actual perimeter of the landing area within which it is safe to land and operate. The International Convention requires that boundary lights should be red in colour, but the various meetings of the International Illumination Commission have gone to show that there is from the technical aspect international agreement that normally they should be orange in colour and fixed in character.

It is also suggested, as the result of certain experiments which have been carried out, that they should be spaced at intervals of 300 ft. on the perimeter of the landing area. This figure was found to meet the requirements of a pilot being able at a glance to draw an imaginary line around the landing area, and yet was economically possible. The pilot obtains the direction and possibly the velocity of the wind by reference to an illuminated wind indicator in the form of the letter "T," both arms of which should be approximately equal in length, and not less than 16 ft. in length. The apparatus is so fitted with vanes along the main arm that it lies with the head at 90 deg. to and against the wind, and should be outlined by white light, or any colour approximating thereto, to an intensity of 10 to 15 candles per foot run.

To avoid danger when gliding down, all obstructions around and on an aerodrome should be outlined vertically and horizontally with red lights. Finally, the machine should land over, and down the beam of, a landing area flood light. Such are the conclusions of the British Aviation Lighting Committee, and technical data are to be issued in the form of a British Standard Specification.

* * *

Electroculture

The results of the electrical treatment of soil, seed, and plants were described at the ROYAL SOCIETY OF ARTS in London on November 16th, by Mr. S. S. Nehru, an Indian, who is a member of the Advisory Board of the Imperial Council of Agricultural Research. Lantern slides indicated the more vigorous growth and larger blooms which were obtained by means of electrical stimulation, and Mr. Nehru explained how the treatment of poor soil increased its nourishing properties and enabled a variety of seeds to grow which would not otherwise germinate in it.

Power Factor Correction

At the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 13th, Mr. E. L. Fairclough opened a discussion by saying that bad power factor, even to-day, did not receive the attention it required, and when a supply authority took no special measures for dealing with this wasteful and preventable defect the consumer with a good power factor load was penalised. This position might be justified if there were not a remedy at hand for every case. Prevention was better than cure, and motors should be run as nearly fully loaded as possible, avoiding low speeds when practicable. He described the different devices for improving power factor, but his own view was that the static condenser would meet nearly all requirements, for it could be installed at the very extremity of supply, used in small units, and even applied at the terminals of a machine of bad power factor. Condensers would have no effect upon delicate balanced-feeder protection systems, but the result of the condenser's function might compel the adjustment of the protective devices.

Magnetic Surveying

The measurement of magnetic field distortion was the subject chosen by Prof. A. O. Rankine for his presidential address to the PHYSICAL SOCIETY in London on November 17th, thus indicating the possibility of improving the methods at present employed in magnetic surveying in relation to the determination of hidden geological structures. Available types of portable magnetic variometers were referred to and their limitations mentioned, the president's aim being to explain how, at least theoretically, the principle of the gravity balance could be applied to an equivalent magnetic instrument.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Where Good Meter Readers Go

Further to Mr. J. L. Reading's remarks upon Mr. F. H. Fullerton's article. I have resided in Vancouver, B.C., for the past twelve years, and there I was in constant contact with employés in the meter department of the B.C. Electric Railway Co., and I would suggest that it is not entirely beyond the bounds of all possibility for meter readers to make 300 readings per day.

In most cases it is not necessary for the meter reader to enter the building, the meters being situated in a small box compartment built into the house wall structure and covered by a glass window or hinged door. The meter dials face outward and are easy of access for reading purposes through the window or door. The racking of all the individual suite meters on one compact structure in the numerous apartment houses tends to the rapid reading of meters in groups, which raises each reader's daily average and also offsets any longer periods required to read meters that are less easy of access in some of the older buildings and in more sparsely populated and isolated districts.

GEORGE T. BELL.

London, *November 19th.*

I was not surprised to learn that Mr. J. A. Reading finds that a meter reader only makes one entry in three calls.

My American experience has made me a strong advocate for better service entries in English installations. By installing the meter, fuse box and main switch in a recess, in a convenient place (preferably hidden) on the outside of the building, many advantages can be secured, the chief of which is the ability of the supply company's employés to gain access to the meter for reading, &c., without calling the consumer. Secondly, easier and cheaper service connections can be made, and last, but not least, in case of trouble while the premises are unoccupied, the service can be disconnected by anyone from the outside. This method has even been improved upon by the introduction of the outdoor weatherproof meter.

FRED A. TRIM.

London, S.W.17, *November 19th.*

The Heating of Lampholders

Regarding Mr. Bolt's letter in your issue of November 3rd, the following figures of actual temperatures will no doubt be interesting and useful to many of your readers. For further information on this subject, reference should be made to Technical Report F/T. 52 of the British Electrical and Allied Industries Research Association. Scientific investigation and the following figures explode the fallacy of dissipation of heat in fittings by ventilation.

A good-grade bakelite holder was used, the ventilating slots in the skirt being plugged up in the second test. A 14 in. R.L.M. reflector was used for the test with a 100-W lamp, the ambient temperature being 60 deg. F. The temperatures were measured with the thermocouple embedded in the flexible at ⅛ in. from the terminal. It should be noted that the maximum temperature allowable under I.E.E. Regulations is 120 deg. F.

The temperature of the flexible with the bakelite holder with ventilated skirt rose to 153 deg. F.; with the skirt unventilated to 157.5 deg. F.; and with the "Saaflux" R.L.M. to 102 deg. F.

HOWARD LONG.

London, N.17, *November 14th.*

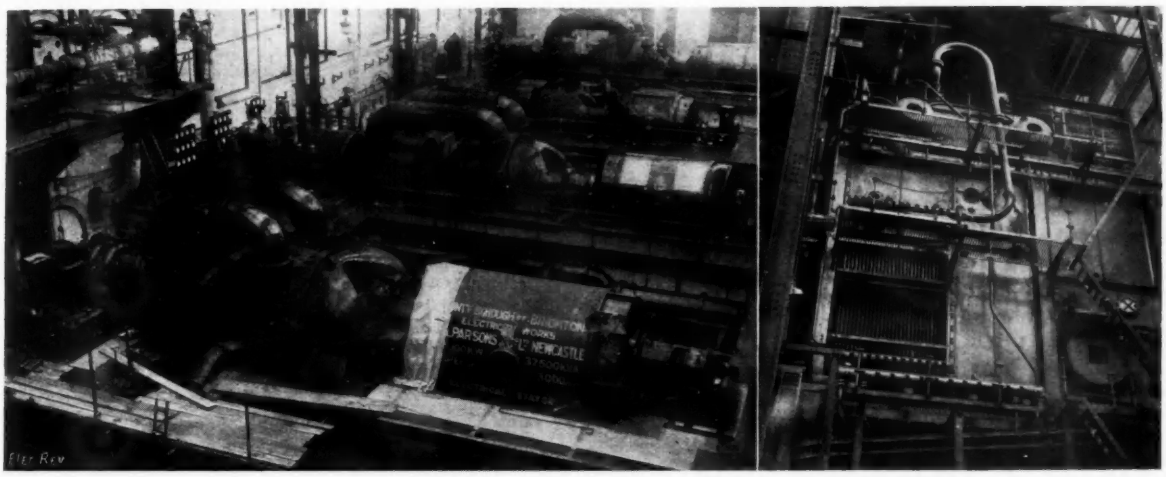
An Italian Telephone Contract

When reading the ELECTRICAL REVIEW for November 10th I noticed a paragraph on page 678, which, I think, may give rise to some misapprehension. Under the heading "Italy—Telephone Orders in America," you quoted a report from *Reuter's Trade Service* (New York) regarding the important extension to the Italian underground cable system placed by the Italian Government with the Società Italiana Reti Telefoniche Interurbane, and state that the apparatus will be manufactured by factories associated with the International Telephone and Telegraph Corporation.

The heading may give the impression that the apparatus will be manufactured in America. The International Telephone and Telegraph Corporation has no telephone factory in America and has entrusted the whole order to Standard Telephones and Cables, Ltd. The equipment will be manufactured in England at our works at North Woolwich and New Southgate.

E. S. BYNG,
Vice-chairman, Standard Telephones & Cables, Ltd

London, W.C.2, *November 15th.*



The engine room at Southwick power station, Brighton, with the new 30,000-kW Parsons turbo-alternator in the foreground and an unusual view of one of the new boilers in course of erection (See note on page 748)

An Intrusive Plant

We recently experienced a shut-down in one of our substation kiosks, which was due to a very interesting cause. It appears that a bracken fern had grown through the hole in the concrete base through which the h.p. cable passed, and eventually found its way to the roof of the kiosk, where it dropped over and short-circuited two phase contacts of the h.p. switch, thus tripping the transformer out of circuit. The length of the fern was 6 ft.

E. J. R. PYMAN, Grad. I.E.E.,
(Lowestoft Corporation Electricity Dept.)

Lowestoft, *November 14th.*

Inefficient Driving by D.C. Motors

I was very interested in the tachograph charts reproduced in Mr. Short's article on this subject. It is rather surprising to learn that under certain conditions there can be a maximum speed variation of 20 per cent. with direct-current drive. I noticed that all examples were cases of group driving, and wonder what fraction of the speed variation could be accounted for by belt slip.

The author's explanation of the tardy response of the d.c. motor to the demands of a rapidly varying torque fits the case, so far as the differential compounding of the field windings, or such like, goes; but, assuming a constant field flux, the armature current of the d.c. motor can build up just as readily as the rotor current of the a.c. motor. That is, of course, assuming constant armature voltage.

What is, I think, a factor in giving such a wide variation of speed under these conditions is the transient drop in voltage at the brushes, which is in excess of the figure given by any

calculations of the resistance drop. I would be interested to see a record of armature volts taken simultaneously with the chart from the tachograph. It is one additional defect from which the a.c. motor does not suffer, and the conclusion that such a motor is pre-eminently suited to drives of rapidly varying torque, drives where constant speed is desirable, is beyond dispute.

On the other hand, there are conditions under which the d.c. motor is difficult to replace, and to suggest that all the privately generated d.c. power is inefficient, as the article seems to imply, is far from the actual fact. The idea that the 2½ million h.p. of privately generated power should be switched over to the grid, needs further examination. While it is desirable, from the national point of view, to secure this load for the grid, the transfer must meet the engineer's requirements—efficiency, economy and reliability.

Gainsborough, *November 20th.* W. S. JORDAN.

A Contractor's Plaint

I think the following may be of some interest, if only to justify a few of the hard things which are said by contractors, about supply authorities

Some time ago a gentleman came to our shop and asked our price for wiring his new house to his specification; the

A display by the Hackney Electricity Department at this week's "Local Industries Fair"

price was duly given, and our tender was accepted, verbally. Our prospective customer appears to have been in communication with the local supply authority (which also undertakes contracting), for later we received the following letter:—

> "With reference to your quotation for wiring bungalow I regret very much that I now cannot accept same, as I find that the main cable will need to be laid some 90 ft., and if I do not take advantage of the two-part tariff, the cost will be prohibitive, and, apparently, the company must do the wiring on such terms. However, I will keep you in mind when the fittings for same are required."

Perhaps I should add that the ordinary tariff in Berwick is 4d. for power and 9d. for lighting. E. W. DEVENISH.

Berwick-on-Tweed, *November 17th.*

A Warning to Contractors

Like "E. C.," we can see "the writing on the wall." Though our eyes grow dim the writing grows larger every year and it is fairly safe to predict that in a few years hence there will be as few electrical contractors as there are gas-fitters trading now.

What with municipal trading with the ratepayers' money in an endeavour to squeeze out the contractor and the competition of the supply companies, one of which after receiving a signed application form bearing our name as contractors, wrote to our clients for permission to quote on favourable terms, it is obvious that we want some strong organisation to fight for us and protect our interests.

One of the associations referred to by your correspondent has, we think, been in existence for some twenty-five years or more, and judging by the prevailing state of affairs it would not appear that "E. C." will derive much benefit by joining it.

November 20th. E.C.2.

Losses in Rural Demonstration Schemes

It is illuminating to note from the Electricity Commissioners' report for the year ended December 31st, 1932, that the Bedford scheme inaugurated on April 1st, 1930, shows a net deficit of £2,607; and the Norwich scheme inaugurated in November, 1930, a net deficit of £3,195, notwithstanding that the latter purchased energy at £2.74 per kW and 0.16d. per kWh, which, by the way, is very much lower than the price quoted by the Central Board to my undertaking for a larger quantity. I should like to know if these deficits are in addition to contributions (if any) of the nature of development grants or the like. Also if the loan redemption periods are normal. Having had over thirty years' experience in supplying electricity in rural areas I am not at all surprised at these deficits.

In my opinion it is, and will remain, quite impossible to supply a very large proportion of the residents in the rural areas with electricity for cooking and heating at a price that is economic to both parties until the Commissioners' regulations—particularly in respect of permissible voltage variation—have been considerably relaxed, and even then supplies to many isolated consumers in country districts will be economically impracticable.

There is not the slightest doubt that, for at least many years to come, in the majority of cases the consumers in urban areas will have to bear the loss incurred in respect of supplies to consumers in the rural areas.

Nov. 20th. BOROUGH (AND RURAL) ELECTRICAL ENGINEER.

Hot-plate Testing

With reference to the article under the above heading in your issue of November 17th, commenting on the Technical Report entitled "Methods of Testing Hot-plates" issued by the British Electrical and Allied Industries Research Association, there do not appear to be any tests appropriate to transformer-operated hotplates with unbreakable exposed red-hot low-voltage heating elements which are making such rapid headway.

If I am correct this is unfortunate, as in my opinion an enclosed type hot-plate is hopeless for a quick *first* boil, particularly if a special utensil is not used, which is usually the case. Also I think a life test of five 100-hour periods is quite inadequate. INTERESTED.

November 20th.

Why the Difference?

The cost of generation of electric power in the Barking station is stated to be ½d. per kWh inclusive of all interest charges; yet in the Weald of Kent the charge works out at 10d. to 1s. per kWh for lighting and 2d. for power. Who takes the profit? And what chance do I stand of getting a dinner cooked when there is no gas supply in the district? I, for one, am going back to oil lamps. E. BLAGBOROUGH.

Wadhurst, Kent, *November 20th.*

A 37,500-kVA Diesel Station

FOR the first time on the American continent Diesel engines have been used to drive the generators of a major power station. The circumstances are somewhat unusual in that the site of the station is the geographical centre of the community, which is also coincident with the electrical load centre of a compact area of high load density. *Power* states that it is America's largest Diesel generating station, and it commenced operating in June last.

It was built by the Department of Light and Power of the city of Vernon, California, the cost of $3,900,000 being covered by a bond issue. Vernon is an independent isolated municipality, about four sq. miles in area, completely surrounded by other incorporated areas. It is highly industrialised, and has a present load density of approximately 10,000 kW per sq. mile.

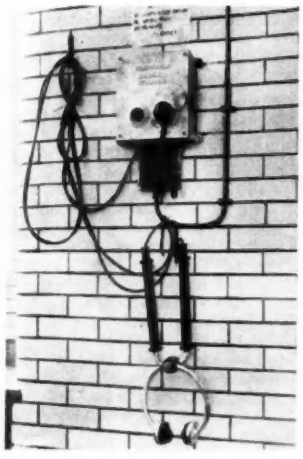
The station is designed on the unit principle right through from the engines to the outgoing feeders, each set being an independent operating unit complete with its own accessories. Each of the five sets consists of a 7,500-kVA, 0.8-p.f., 7,200-V, 50-cycle alternator driven direct by a 167-r.p.m. eight-cylinder, double-acting two-cycle solid-injection cross-head type Hamilton-M.A.N. engine with a cylinder bore of 24 in. and a piston stroke of 36 in. Flywheels are not provided. The scavenging air required by the engines is provided through five washers by five blowers, each driven by a 400-h.p. 3,000-r.p.m. induction motor.

Besides the cylinder jacketing, the pistons and rods are cooled by distilled water, obtained by utilising the exhaust heat to generate steam for an evaporator. The cooling system is closed, the distilled water circulating through heat exchangers that transfer the heat to raw water which is pumped through a forced-draught cooling tower, also sectionalised to conform to the unit scheme of operation. An engine can be started in less than two minutes. Magnetic control is provided for all the auxiliaries and the operator merely presses push-button switches in sequence. Leeds and Northrup automatic load and frequency control is combined with the engine governors.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electricity in the Abattoir



Electric pig-stunning apparatus

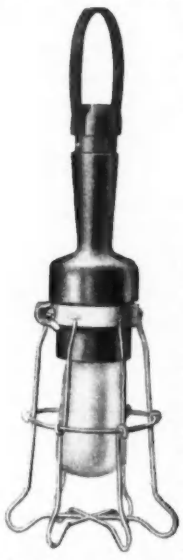
After complete reconstruction and transfer to modern methods, the pigs' slaughter house at the extensive Blackburn Corporation abattoir has just been opened. A new system of electric stunning has been brought into use with apparatus made by MESSRS. SIMPSON BROS., Hapton, from designs prepared in collaboration with Mr. W. A. Royle, the Corporation electrical engineer, and Mr. E. J. Burndred, the veterinary surgeon. The accompanying illustration shows the apparatus. The device resembles a large pair of garden shears, the blades being curved like the jaws of a pair of calipers. From a plug an electric lead passes through each of the heavily insulated handles and the jaws terminate in a pair of discs or electrodes. The butcher clips the electrodes firmly behind the pig's ears, presses a switch in the handle, and the animal is instantly stunned. The knife can then be used without pain. The electrode discs are covered with rubber sponge, making a perfect contact when soaked in salt water, at the same time eliminating any danger of scorching of the flesh.

D.C. " Supervox " Radio

We are informed by MCMICHAEL RADIO, LTD., 265, Strand, W.C.2, that the production of a "Twin Supervox" broadcast radio receiver for d.c. mains operation at from 200 to 250 V has commenced. The new instrument will be retailed at the same price, namely 18 guineas, and be externally similar in every way to the existing a.c. model, which is fitted with two loud speakers, a grille being placed on either side of the tuning scale, which is in the centre of the polished walnut cabinet.

New Handlamp

The new "Treva" handlamp illustrated herewith complies with H.O. regulations, and is priced at 4s. 6d. without the lamp or flexible cord. The manufacturers are MESSRS. TREVELYANS (BIRMINGHAM), LTD., Bracebridge Street, Birmingham, 6. As will be seen, the lamp is of very neat design and the guard can be removed easily. A hanging strap is provided.



The " Treva " handlamp

A New Insulating Paper

MAXIMON, LTD., Barking, have sent us details and samples of a new insulating paper, produced from a basic paper of British manufacture, for which is claimed high dielectric properties, great tensile strength, perfect flexibility without loss of dielectric resistance, freedom from surface irregularities, and a surface capable of resisting solvents and dilute acids and lyes. Initial experiments were conducted with a view to finding a satisfactory impregnating solution which would dry at a reasonable temperature, so that the paper would be unaffected. It was then necessary to make provision to enable the paper to be made under commercial conditions, and at the same time avoid surface imperfections. Because paper cannot be handled from the moment of dipping until the drying point is reached, slow drying presented a serious difficulty, but it was successfully overcome by adjustments in the impregnating solution and by ingenious variable temperature devices upon the saturating machine.

To ensure thorough and even saturation, the paper is twice impregnated under pressure, whilst the drying features of the machine are carefully adjusted to make certain that the drying process is perfectly even. The paper is being supplied in rolls with a waxed surface in various thicknesses, but it can also be supplied cut into tapes when required in that form.

Tests undertaken at the Faraday House laboratory have shown that the claims that the insulating paper has a high dielectric strength and a particularly high tensile strength are fully justified.

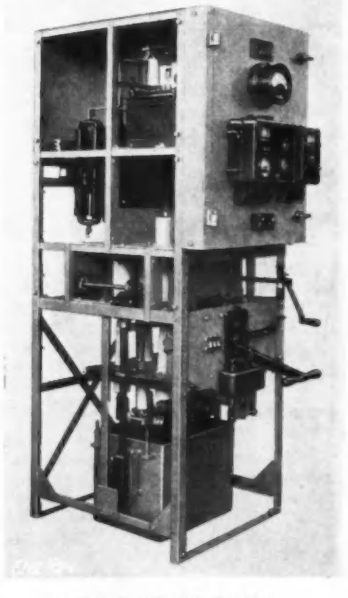
A Simple Time-switch

MESSRS. MACKAY & Co., Percy Road, Whitton, Middlesex, in association with Mr. O. S. Corbett, are introducing the " Victory " time-switch, which actuates existing tumbler switches or ironclad switches up to 15 A. The controlling mechanism is a specially constructed clock suspended by two springs from a hook, which can be readily fitted above the switch or switches. No additional wiring or installation work is necessary. The clock can be easily rotated for winding without being removed from its supports, thus eliminating any chance of its being dropped. It can be fitted whilst the circuit is on load and calls for no skill in adjustment. The prices of the two models are 15s. and 21s.

The " Victory " time switch

Compact Switchgear

A new design of switchgear, known as type " S.V.D.," which has recently been placed on the market by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, can readily be adapted for ring main service, oil-immersed isolating links being provided to isolate either side of the ring main. These " S.V.D." units comply in every respect with the appropriate British Standard Specifications and H.O. Regulations, and are suitable for use on single- or polyphase systems up to 11,000 V, while oil circuit-breakers up to 150,000 kVA can be accommodated. Standard units are painted battleship grey, while the instruments, oil circuit-breakers, interlocks, &c., are finished in black. A typical switchboard is illustrated. Further units can readily be added to an existing switchboard. Each unit is arranged for floor mounting, and is built up of sheet-steel plates fixed to rigid angle-iron framework. The equipment is jig assembled, so that parts are strictly interchangeable. The bus-bar chambers are arranged at the top of the switchgear, while the oil circuit-breakers are situated immediately below. Self-contained instrument panels are mounted in front of the bus-bar chambers, and are provided with hinged front plates to facilitate inspection. A separate compartment at the back of the bus-bar chamber houses the current transformers, while potential transformers, of the air or oil insulated type, can be mounted above the bus-bar chamber, the height of the complete unit being slightly increased.

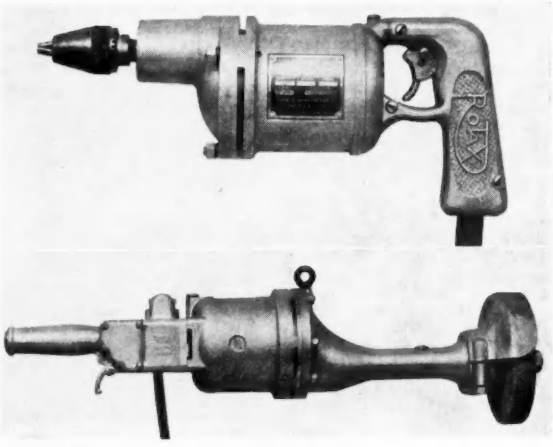


A G.E.C. " S.V.D." unit

Arrangements are made for vertical drop-down isolation of the oil circuit-breakers, which are provided with terminals of the blade-contact type, designed to engage with the fixed contacts of the bus-bar and circuit connectors, which are of the line-contact controller pattern. The raising and lowering mechanism for the oil circuit-breaker and tank comprises two lifting screws which are connected to the oil circuit-breaker tank and operated through bevel gears by means of a handle at the front of the unit. Guides are provided to ensure correct registration of the breaker contacts with the fixed contacts of the bus-bar connectors. Should it be necessary to inspect the breaker contacts, two bars are supplied which are inserted horizontally in the holes provided in the framework and support the top cover plate of the breaker. The breaker top plate nuts may then be removed, after which further operation of the gear lowers the tank so that the contacts are exposed. Alternatively, if the supporting bars are

omitted, the complete breaker can be lowered on to a suitable truck and withdrawn from the unit. A removable shutter plate is provided to cover the bus-bar and circuit connector sockets when the switch is isolated. Complete interlocking of the lowering mechanism provides absolute safety to the operator. Any modern form of protection can be provided.

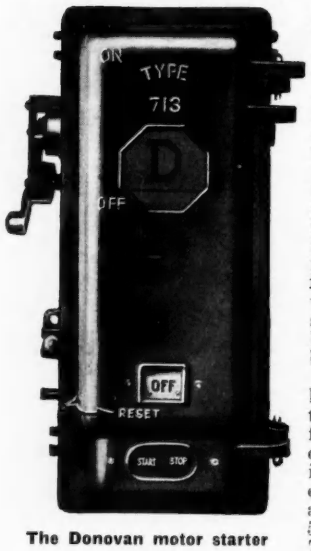
Cable box arrangements are very flexible and multi-panel switchboards embody a bus-bar chamber, which runs along the top of the switchboard, and the outgoing cable boxes can only be fitted vertically below the current transformer chamber, at the rear of the unit. In all cases ample space is provided for jointing the cables, access being obtained from the front.



New " Rotax " tools: Above, the ¼-in. h.f. drill; left, the 6-in. portable grinder; and right, the 9-in. h.f. sander

A New Starter

The DONOVAN ELECTRICAL CO., LTD., Great Charles Street, Birmingham, has introduced a push-button operated a.c. direct-on-line starter fitted with a self-contained switch and fuses for three-phase squirrel cage motors, which combines in the same case a triple-pole 20 A contactor panel fitted with an " on " and " off " indicator, no-volt and thermal overload protection, three high rupturing capacity fuses and an interlocked triple-pole isolating switch. The starter is operated by closing the isolating switch and pressing the " start " button, which closes the contactor switch, and is dropped out by pressing the " stop " button.



The Donovan motor starter

The dimensions are 16⅛ in. high by 9½ in. wide, and the approximate projection from the wall is 4⅞ in. overall. The enclosing case is of cast iron with cable entry for screwed conduit, and the maximum rating is 5 h.p. 220 V three-phase and 7½ h.p. 400/550 V three-phase. The makers claim that the use of this starter greatly reduces installation charges, and they offer in one unit, overload, single-phase, stalled-motor and short-circuit protection. The starter complies with Home Office requirements, as the isolating switch is interlocked with the cover and all " live " parts are protected when the lid is open.

New Osram Valves

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, informs us that supplies of the " V.P. 21 " h.f. screen pentode valve are now available, the first for 2-V battery sets. The peculiar features of h.f. screen pentodes probably show up to best advantage when applied to battery valves, since in this case the anode voltage is usually restricted, and this limits also the voltage magnification obtainable. With a pentode, in which the negative " kink " of anode current is neutralised by the suppressor grid, much lower anode voltages may be employed than with screen grid valves before distortion sets in. Therefore when using only 100 V considerably greater undistorted voltage output is obtainable than with a tetrode.

The " V.P. 21 " is designed with the further advantage of " variable mu " adjustment by which full control of conductance, and, therefore, of volume, is obtained with a bias battery of only 9 V. The type will be supplied only with seven-pin base fitting and metallised finish; the metal coating is taken to one of the seven pins, and may be earthed.

High-frequency Electric Tools

A full range of high-frequency electric tools has recently been placed on the market by MESSRS. NEWTONS OF TAUNTON, LTD., 319, Regent Street, W.1. They are made by ROTAX, LTD., Willesden Junction, N.W.10, and are, it is claimed, the first entirely British-made tools of their kind. The features of this range of tools is that they maintain a constant speed when under load, combine a high productive capacity with low weight, have a simplified motor construction, and lower maintenance costs.

The motor is of the squirrel-cage type made with bare copper bars, riveted and welded in position, and all rotating parts run on large size bearings, while the spindles, gears, and other similar parts are made of heat-treated alloy steel. The motor housings and gear cases are made of a special aluminium alloy, and are held together by studs and nuts.

The tools are capable of prolonged full-capacity operation without overheating. All motors operate on 110 V, three-phase, 175/180 cycles, but can be supplied for 220 V at the same price. Brief specifications of the six models available are as follows: ¼-in. drill, 1,800 r.p.m. (no load), weight 6½ lb., price £12; 5/16-in. drill, 1,500 r.p.m., 7 lb., £13; ½-in. drill, 500 r.p.m., 17 lb., £21; ⅝-in. drill, 500 r.p.m., 18 lb., £22 10s. (the last two are fitted with side and spade handles); ¼-in. auto-feed drill, 245 r.p.m., 32 lb., £34; 6-in. portable grinder, 3,700 r.p.m., 17½ lb., £22 10s. (flexible pad £2 extra).

An Improved Window-cleaning Machine

In our issues of October 21st and November 18th, 1932 (pages 607 and 750), we illustrated and described an electric window-cleaning machine supplied by MESSRS. TURNER (NU-ESTE), LTD., 4, Albert Square, Manchester, 2. We now learn that a very much improved model, made by the British Thomson-Houston Co., Ltd., is available.

The fractional horse-power motor is suitable for either a.c. or d.c., and the sturdy driving shaft and extension shaft give ample reach for large windows. The price, 17 guineas, includes full equipment (motor, shaft drive, gear head, extension piece, flex, and four mops), and it can be obtained 6 ft. 6 in. long to reach surfaces 13 ft. high, or 2 ft. 2 in. long for showcases, mirrors, &c.

A switch is incorporated in the handle just above the motor, and the machine polishes as well as cleans, and climbs under its own power.

Batteries for Radio Sets

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38/39, Upper Thames Street, London, E.C.4, are introducing two new sizes of " Full o' Power " double-capacity batteries specially designed to fit the cabinets of the new Cossor battery sets. For Cossor sets, Nos. 335, 341, 342, 344, 345, 346 and 735, the size of the 120 V battery is 10⅝ in. by 8½ in. by 3 in. high, while the dimensions of the battery for set No. 634 is 12¾ in. by 8½ in. by 3 in. high (135 V).

Adjustable Lighting Fittings

A new line of adjustable office lighting fittings has been introduced by the ELECTRIC DEPÔT, LTD., Pritchett Street, Aston, Birmingham. The maximum extension of the 14s. model is 21 in., and it has two joints. The fitting can be obtained to clamp on to a table up to 1½ in. thick, or with a 3¾-in. screw-on circular base. Another model, priced at 16s. with one arm or 20s. with three arms, has a universal movement, and is supplied with a fixing base for bench, wall or desk fixing, but for one shilling extra a wrought bracket for wall fixing, provided with a conduit box, tapped ¾in. at the top, can be provided. Side or through tapping is also available at the same price.

A new three-arm adjustable fitting

The reflector is of the concentrating type finished in green and white; the body and carrier are of aluminium, thus reducing the weight at the end of the bracket, and preventing any tendency to sag when it is mounted on a vibrating machine or bench.

For £3 10s. a similar three-arm fitting mounted on a telescopic adjustable column can be obtained, a swivel action, independent of the telescopic movement costing 10s. extra.

A special model for inspecting the underneath of motor car chassis, etc., costs 35s. with one arm and 39s. with three arms. In all sizes the arms fold right up when the lamp is not in use.

Assisted-wiring Schemes. By G. D. Bond, A.C.I.S.

A method of costing and control

IN the scheme assumed the cost of the installation is to be repaid by the consumer by an addition to the charge per kWh. Included in the cost of the installation is a charge for interest upon outstanding balances of cost due and for the cost of repairs and maintenance to be done by the undertaking until the cost is repaid. The number of kWh necessary for repayment is scheduled according to the number of points at which a supply is required, a heating plug counting, say, as a half-point.

When an agreement form has been completed by the consumer and approved by the undertaking, triplicate copies of the order will be made, one being retained in the cost office as a progress record. The other copies will be forwarded *via* the cost office to each other section (installation, services, test, meter and accounts) as the work progresses, one copy being held by the sectional head, and the other being used as an instruction to workmen. Thus, the cost office staff will keep track of each job, and the cost office will accordingly fulfil the additional function of a central record office, obviating sectional record offices and securing a saving of administrative expenditure. When the consumer decides, during the installation work, to have additional points installed, he should be required to complete a supplementary agreement form attached to the work order.

TIME SHEET—WEEK ENDING ..... 193.....

NAME TALLY No.

TIME.	WORK ORDER NO.	POINTS.	HOURS WORKED ON EACH JOB. MON.	TUES.	WED.	THURS.	FRI.	SAT.	OFFICE USE.
ORDINARY									
OVER									
*OFFICE USE									
			(REPEATED AS REQUIRED)						
TOTALS									

INSTALLATION, SERVICES, TEST, METER } CROSS OUT WORKS NOT APPLICABLE

HOURLY RATE OF PAY

SUMMARY.
ORDINARY TIME
OVER AND EXTRA TIME _____
TOTAL TIME _____

* Extra time allowance for overtime worked inserted on third line.

The forms of work order should be numbered consecutively and should contain provision for (at least) the following information: Name and address of applicant; date application received; application folio; account number; supplementary application; schedule of installation; progress record; service data; meter data; and accounts data.

Labour

No work should be executed by any section without the previous receipt of a work-order from the cost office. Each workman will complete a weekly time-sheet, which will be used as a basis of allocation of wages to the various accounts required by the scheme. A saving in clerical work is effected if three lines only of the time sheet are used for each job, a weekly summary being easily secured of the time of each workman employed on each job, as in the first table.

Before analysis is made for costing, the time on each sheet will be checked against the weekly wage sheet record, which will be compiled directly from clock-cards or tally records kept by time-keepers. At the same time, the hourly wage rates will be copied on to each time sheet. Time sheets will then be sorted, first by sections (installation, services, testing, meter) and thence according to wage rates. An analysis will then be made to show the total number of hours for the week at each wage rate applicable to each cost account. For work done by the installation section, a separate cost account will be necessary for each size of installation (4-point, 4½-point, 5-point, &c.). For work done by the other sections (services, testing, meter) one account only will be necessary for each section.

In order to minimise error, the analysis will be done by the use of duplicate posting slips. The form shown in the second table is suggested for the installation section. For other sections, analysis according to the size of installation is not necessary, and the form may be modified accordingly.

If an analysis is made on the weekly wage sheets of each wage according to the average hourly rate of pay, sundry miscellaneous rates being grouped together, the weekly number of hours at each rate may be brought into agreement with the totals posted according to a summation made of the duplicate posting slips. At the close of the month, time analysed to uncompleted jobs will be so marked in the cost office by reference to the assisted-wiring progress summary. The analysis will then be totalled, a sub-division of time being made to completed and uncompleted jobs. Time may then be priced in bulk at appropriate rates, thus securing economy in detail work. Hours and cost totals will thereafter be posted to A.W. monthly cost summary. Any discrepancy between the monthly labour cost in the analysis sheets and the weekly wage sheets may be easily adjusted at the foot of the final analysis sheet.

MONTH ..... 193..... HOURLY WAGE RATE: SECTION: _____

WORKMAN'S TALLY NO.	JOB NO.	TOTAL HOURS AS PER TIME SHEETS. 4 POINTS.	4½ POINTS.	5 POINTS.	ETC.	9 POINTS.	TOTAL.
MONTHLY TOTALS							
COST							

Stores

A schedule should be prepared of stores required for each size of job. Upon receipt of a requisition from the office for material wanted at various jobs upon specified dates according to a progress schedule, the appropriate material will be made up and delivered at the premises for the date required. Any further requirements will be obtained by means of a requisition to store direct from the appropriate foreman.

Material left over from jobs will be immediately returned to stores, accompanied by a stores credit note. It will be a duty of the employé testing the installation to see that this is done. After materials have been issued, stores notes will be forwarded to the cost office. The notes will be serially numbered and entered daily in a guard book as received from stores, each book of notes thus being accounted for. Analysis of material is simplified where the bulk of stores used is issued to schedule. For the installation section the total quantity of each class of material issued during the month for each size of installation is required: but for the other sections only the total quantities are necessary. Provision will be made on the stores summary sheet for inclusion of serial numbers of stores notes and A.W. work order numbers.

At the month end, material used on uncompleted jobs will be so indicated by reference to the A.W. progress record kept in the cost office. Material will then be priced to give the total cost of material used as required by the cost accounts. Total quantities of each class of material used will be posted to the appropriate accounts kept in the stores ledger, which forms an important part of any comprehensive stores system.

On-cost comprises all charges applicable to the scheme except the cost of labour and material directly chargeable to specific jobs, *i.e.*, supervision, storage and establishment. In some cases sectional labour and stores materials may be used under these or similar headings, and, in order to collate such items, a series of standing order numbers will be operated, and these will perform a similar function to work-order numbers.

At the beginning of the scheme a careful budget of on-cost made to ascertain the schedule costs may be used as a basis of comparison with the on-costs incurred. Each item of actual on-cost for each month needs to be carefully scrutinised in the light of the original estimate, and the figures of previous

periods as the scheme progresses. The estimated on-cost per job will be allocated to each section of each work-order, and the estimate should be based on an assumption of maximum output, an adjustment being made for the average estimated output. In arranging the schedule for repayment of installation costs, the adjusted estimated on-costs would be utilised by the department.

For installation work, on-cost will be allocated on a differential basis according to the number of points in the installation; in the other cases the allocation will be made on a unit basis per job.

Labour, material and on-cost charges for each month will be posted to a cost summary, so designed that the average cost of each size of installation, and the average cost of service laying, installation testing and meter fixing for the month may be clearly shown. Comparative figures to date and for the previous month will be given in each case, in order that adequate control may be exercised. An additional unit for comparative purposes, which may be readily compiled for installation work, is a simple statement of the average number of direct labour hours per point

Repayment

Where installation work is financed by means of a loan the schedule of repayment should be based upon redemption within the loan period. It is essential that information be regularly available as to progress of repayment.

A consumer's account will be kept in each case, and compiled in the consumer's office from meter inspectors' returns of visits to consumers' premises. It is advisable to use Paramount cards in this connection, whereby the accounts may be rapidly sorted as required, *e.g.*, to size of installation, district, or average consumption. By means of a listing machine the average repayment amount per quarter, or other period, for each size of installation is easily available. An intensive canvass to induce increased average consumption per point may be indicated in certain cases, and for this alone rapid disclosure of data is required.

Where the cost per schedule of installations is greater than the average actual cost, the difference can be offered as a rebate on purchases of approved types of electrical apparatus. If the installation cost is paid well within the schedule time (*i.e.*, the time assumed in fixing the schedule costs), it may be effective to offer to install a permanent apparatus, such as a water heater, which will be paid for in the same manner as the cost of the installation is met.

Generally, the maintenance system will operate as in the case of the original work, a serially numbered A.W. maintenance work-order taking the place of A.W. work orders. In addition to the unit cost data, information may be required as to the class of repair and maintenance work done. A series of code numbers will be compiled for this purpose, and Paramount cards will be utilised as maintenance work-orders, so that a periodic analysis may be made of the occurrence of various types of fault.

A quarterly cost statement is indicated in connection with this class of work, with comparative figures for previous periods.

New Books

Direct and Alternating Currents. By E. E. LOEW, E.E. Pp. 656; figs. 485. London: McGraw-Hill Publishing Co. Price 27s.

The intention of the author of this very bulky volume is to cover the fields of d.c. and a.c. theory and machines in a single volume and also to include some account of the principles of electric power transmission. The standard aimed at is of an intermediate nature, that is to say, the treatment is more complete than is required for an Ordinary National Certificate course, but hardly so complete as is necessary for a Higher National Certificate course.

The definitions given of certain electrical units, notably those for current and resistance, are what may be termed the legal definitions or standards rather than the scientific definitions, and this method appears to have certain disadvantages because it has led the author to develop the formulæ for power and work by analogy from hydraulics rather than from the fundamental definitions of electrical units. Further, as a result of the method adopted, the numerical ratios between electrical and mechanical units of work and power are simply stated and not demonstrated from a consideration of the scientific definitions of the electrical units and of the numerical relationships of the various units of length, mass, and force.

Although mathematical theory is reduced to the minimum, the method of complex quantities is adopted throughout in dealing with problems concerning the flow of alternating current. This mode of treatment is being used to an increasing extent and is probably desirable for those who intend to go far in their study of electrical theory, but the advantages do not appear to be very considerable when, as in the present work, only a limited ground is covered.

The general text of the book can be well commended for its clearness and accuracy, few errors being noticeable. Certain of the terms and constants used in the book will not be familiar to readers in this country; thus those working the examples in connection with the conversion of energy from thermal to electrical units may be confused by the fact that a gallon of water is taken as weighing 8.25 pounds, the American gallon, of course, being smaller than the British. The book can be heartily commended to those students desiring general instruction in the subject.

Electrical Circuits and Machinery. Vol. I—Continuous Currents. By J. H. MORECROFT and F. W. HEHRE. Pp. 457; illus. London: Chapman & Hall. Price 25s.

In connection with foreign works, especially when they are costly, one naturally draws a distinction between standard textbooks on subjects like electrical technology and specialised treatises which fill definite gaps. The present volume, which is its second edition, belongs to the former category, and in order to secure recommendation it should at least possess exceptional merit. It is no disparagement to the well-known authors to say that the book was not written for English readers—circular mils and American gauges are sufficient indication of this fact—but the drawback is a real one for students.

The work follows more or less normal lines. The early chapters introduce the electron to explain various phenomena. This is a commendable feature, but we are not sure that the information given will suffice for the solution of the problems at the end of Chapter II. Throughout the book there are many excellent numerical examples. The inclusion of the answers would be an improvement and a help to home students. Fortunately, here and there the authors work out examples in the text, as in the section on Kirchhoff's laws. Many of the photographic reproductions are scarcely worth the space they occupy. On the other hand, there are several useful reproductions of oscillograms illustrating current growth, flux distribution, &c.

The book is fairly complete, and covers most of the elements of continuous-current technology and machines satisfactorily. In places the treatment is sketchy and indefinite, but the book is suitable for those desirous of obtaining an elementary knowledge of the subject.

The Electrical Properties of Glass. By J. T. LITTLETON and G. W. MOREY. Pp. 184; figs. 69. London: Chapman & Hall. Price 18s. 6d.

Preceding monographs issued under the auspices of the Committee of Electrical Insulation of the U.S.A. National Research Council have impressed us with the thoroughness with which the task of recording advance in modern research is being carried out; the present volume, which is devoted to a study of the relation which exists between the electrical properties of glass and its composition, confirms this view.

The authors begin with a general account of the manufacture of glass and a discussion of its properties, including coefficient of expansion, elasticity, thermal conductivity and resistance to thermal shock, and present a valuable table setting out the properties of several multi-component glasses. The other sections of the volume deal with conductivity studies and the dielectric properties of glass, in which the authors advocate further research on the correlation of variations in dielectric absorption with changes in physical properties throughout a series of glasses, and a study in the individual members of the series of the effects of systematically varied physical factors on the behaviour of the absorption current.

The volume is of outstanding value to those interested in electrical measurements and dielectric theory, as the authors have shown that some glasses, so far as their dielectric properties are concerned, are well adapted for use in commercial insulators. As the physical constitution and properties of glass can be varied by changes in composition and heat treatment, it can be utilised with advantage as a material for the study of the fundamental properties of dielectrics.

* * *

Shorter Notices

"Vectors for Electrical Engineers," by E. Mallet (13s. 6d.): "Fluorescence Analysis in Ultra-violet Light," by J. A. Radley and J. Grant (15s.); and "Electrical Engineering Practice," by J. W. Meares and R. E. Neale (Vol. III) (30s.). London: Chapman & Hall.

"Alternating Current Circuits," by M. P. Wembach. London: Macmillan & Co. (20s.).

"Conjugate Functions for Engineers," by Miles Walker. London: Oxford University Press. Price 12s. 6d.

"Power Sales," by D. Taylor. London: McGraw-Hill. Price 10s.

"Theorie der Elektrizität," by R. Becker. Leipzig: B. G. Teuber. Price Rm. 17.00.

"Wireless, its Principles and Practice," by R. W. Hutchinson. London: University Tutorial Press. Price 3s. 6d.

In the Courts

THE First Division of the Court of Session, Edinburgh, on November 17th, disposed of a reclaiming note for the plaintiff in the action by Mr. William G. Thomson, electrical engineer, Edinburgh, against Mr. David Simpson, S.S.C., Edinburgh, as trustee and executor under the will of the late John Graham Thomson, solicitor, and others. Plaintiff, who is Mr. Thomson's nephew, asked the court to declare that a purpose in Mr. Thomson's will was invalid, and that a codicil dated December, 1930, was holograph and binding.

Mr. Thomson, who died in Edinburgh in 1932, was especially interested in the problem of developing electricity from tidal power. In 1925 he purchased a shipyard at Alloa for £8,000, with the intention of erecting a plant there, to carry out a scheme he had devised, and plans were prepared by an Edinburgh firm of engineers. When he died, the work had been partially carried out, but the machinery had not been installed, nor had instructions been given for its construction. Over £6,000 was expended on the scheme, and about £3,000 more would be necessary to complete the equipment of the machinery. In the third purpose of his will, Mr. Thomson directed that the residue of his estate was to be employed in carrying out the scheme.

By the codicil mentioned, he directed, subject to the provisions of the third purpose, that Kelliebank shipyard should be conveyed to the plaintiff, along with the residue of his estate, which would probably amount to about £10,000. The plaintiff averred that deceased's tidal power scheme was useless and impracticable and that it would be a mere waste of money to proceed further with the installation. Respondents, on the other hand, stated that they had been advised that the scheme would work, although, on its existing scale, it might not be a commercial success. In any event, the carrying on of the scheme for the five years stipulated in the will, might lead to an advance in scientific knowledge. That contention was denied by the plaintiff. In the Outer House, Lord Fleming ruled in favour of the respondent.

The First Division now reversed the decision of the Lord Ordinary, holding that the direction of the testator was void from uncertainty, and that the claim of the plaintiff to have the estate handed over to him without further delay was justified. Lord Sands said it had been shown that the projected works were useless for the purpose of demonstrating the practicability of the testator's scheme and his direction was not saved by any evidence of a reasonable prospect of other benefit. Lord Blackburn said that he was satisfied that to go on with the work would only mean the throwing away of good money after bad. The Lord President and Lord Morison concurred.

The Rating of a Glasgow Sign

In the Valuation Appeal Court, Edinburgh, on November 17th, before Lords Hunter, Sands, and Fleming, judgment was issued in an appeal by the Franco-British Electrical Co., Ltd., as owners, and the Scottish Co-operative Wholesale Society, Ltd., as occupiers, which brought under review a decision of the Glasgow Valuation Committee approving of the entry in the Valuation Roll of an illuminated electric sign on Broomielaw Bridge, Glasgow, at rent and rateable value of £250 per annum. It appeared that the Society paid the advertising contractors in Scotland for the London, Midland and Scottish Railway Co., an annual sum of £900 for use of one side of the bridge, and the Society also paid, under an agreement which was to run for sixty months, a quarterly sum of £351 during that period. It was also proved that 62½ per cent. of the £900 was paid to the railway company, and was included in the Railway Assessor's valuation.

The Society contended that the subjects should not appear in the roll because they were not heritable; that they were not tenants' erections; that their value was reflected in the return made to the Assessor of Railways and Canals; that the rights of the appellants were in the nature of a privilege and did not arise from a lease of heritage; that the appellants were neither proprietors nor occupiers; and that the subjects, if heritable, were so only to their attachment to the railway bridge. In any event, the appellants submitted that the annual value should be reduced to £100. For the Assessor, it was contended that the appeal did not truly relate to any question of the annual value of the subjects, but to the propriety of the entry, and that the appeal ought to be dismissed as incompetent. It was further contended that the entry should not be disturbed as the subjects were not part of or accessory to the railway undertaking and were heritable in their nature, and that the valuation was not excessive.

The Valuation Appeal Court sustained the appeal. Lord Hunter, delivering judgment, said he thought it clear that the Committee erred in treating the subject as a tenants' erection within the meaning of the Lands Valuation (Scotland) Amendment Act, 1895. The appellants, the Franco-British Electrical Co., Ltd., were not tenants of anyone, and had not any lease of heritable subjects. This was sufficient for the decision of the case, although his Lordship thought it might be also successfully maintained that the subjects were only heritable, as part of the bridge of which the railway company, which was not a party to this case, was proprietor and occupier. His Lordship doubted the propriety, on the facts disclosed in this case, of treating the sign as a *unum quid* and giving it an independent entry in the Valuation Roll.

An Electric Locomotive Contract Dispute

In the King's Bench Division on Monday last, Mr. Justice Branson, commenced the hearing of an action brought by Vulcan Foundry, Ltd., against Associated Electrical Industries, Ltd., to recover from the defendants, as the successors of the Metropolitan-Vickers Electrical Co., Ltd., the balance of the price of electric freight locomotives excluding their electrical equipment on the assumption that no price had been agreed to. On this head the plaintiffs claimed £36,584 and a further £1,586 in respect of spare parts.

Sir Leslie Scott, K.C., for the plaintiffs, said that the case arose out of a contract made by the Metropolitan-Vickers Co. with the plaintiffs, dated January 27th, 1927, for the supply by plaintiffs, as sub-contractors, of the mechanical parts of thirty-one electric locomotive engines for use on the Great Indian Peninsula Railway. His Lordship was asked to decide only the question of law. The head contract made by the Metropolitan-Vickers Electrical Co. with the High Commissioner for India was for forty-one engines. The question was whether the plaintiffs agreed to make the locomotives for a reasonable price, no price being fixed.

By their defence the defendants set up nine alternatives to that contract and pleaded a couple of estoppels. The curious thing about the case was that the terms of the contract never had been reduced to writing in a single document. That there was a contract there was no question. The thirty-one sets of mechanical parts were made and were delivered.

The case is proceeding and is expected to last several days.

Parliamentary News

(BY OUR SPECIAL REPORTER)

IN the House of Commons on November 15th Sir P. Dawson asked the Minister of Transport whether, in view of the coming into operation of the grid next year, he proposed to introduce any legislation to deal with and to facilitate distribution, in view of the fact that such legislation was essential to the success of the Central Electricity Board.

Mr. Stanley said that the possibility of improving the organisation of the distribution of electricity was naturally a subject which engaged his attention, but he did not accept the suggestion that the success of the Central Electricity Board was dependent on further legislation in the matter.

L.N.E.R. Electrification

On November 15th Mr. Doran asked the Minister of Transport if the recent plans for the electrification of some of its suburban services, submitted to him by the London and North-Eastern Railway Co., included the branch to Tottenham and beyond.

Mr. Stanley said he was informed by the London and North-Eastern Railway Co. that the schemes for the electrification of its Great Eastern suburban services at present under its consideration and that of the Standing Joint Committee set up under the London Passenger Transport Act did not include the line to Tottenham and beyond.

Main-line Electrification

On November 15th Sir P. Dawson asked the Minister of Transport if he had any information as to whether the railway companies were considering any electrification either of suburban or main-line sections outside the area of the London Passenger Transport Board; and what further steps were to be taken to implement the recommendations in the Weir Report and that of the Royal Commission on Transport.

Mr. Stanley said that the railway companies had assured him that they were continuing to give consideration to this matter, but at present he had no information with regard to any schemes of main-line electrification which were likely to be proceeded with in the near future.

A Village Scheme

On November 15th Lord Scone asked when electricity would be introduced into the village of Errol.

Mr. Stanley said that the Grampian Electricity Supply Company had informed him that in order to obviate wayleave difficulties it had arranged to deviate the route of the proposed electric line to Errol, and his consent to the deviation was given on November 1st. He understood that the company hoped to afford a supply in Errol at an early date.

Special Order

On November 15th the Special Order made by the Electricity Commissioners in respect of part of the rural district of Llandilo Fawr, in the county of Carmarthen, was approved.

Bulk Supplies

On November 16th Major Mills asked the Minister of Transport if he would confer with the Electricity Commissioners as to the steps to be taken to press local distributing companies to be ready to take supplies of electricity in bulk from the grid system as soon as it was available, and to pass it on to would-be consumers at a reasonable price.

Lt.-Col. Headlam, who replied, said the Minister was informed by the Commissioners that they were not aware of any reluctance on the part of local distributing undertakers to make arrangements with the Board for obtaining supplies of electricity as soon as they were available.

Business and Industrial Notes

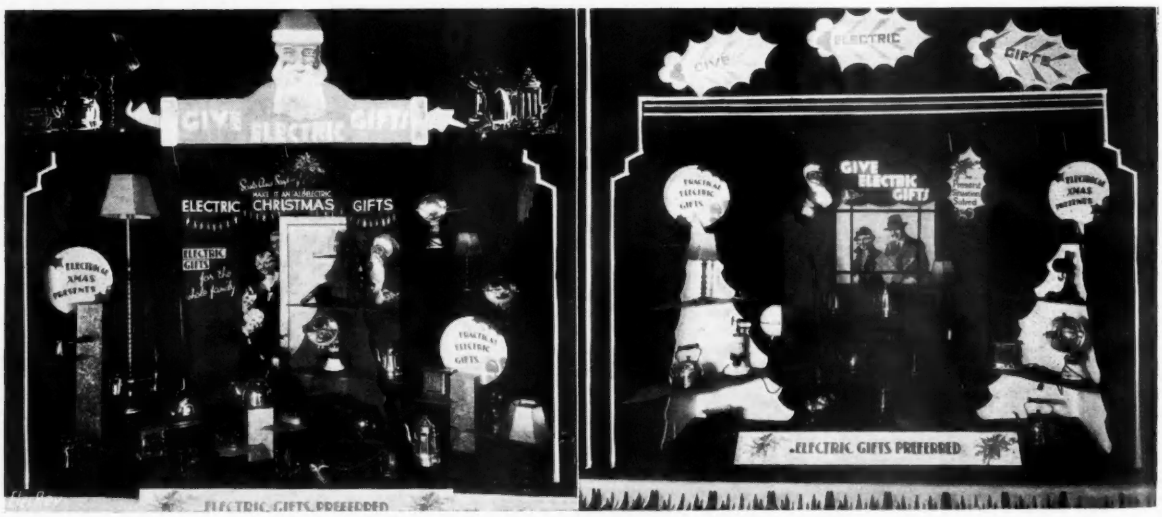
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The Marking of Imported Electrical Accessories

The Board of Trade announces that an Order-in-Council was made on November 10th under Section 2 of the Merchandise Marks Act, 1926, *viz.*, the Merchandise Marks (Imported Goods) No. 15 Order, 1933, which requires certain descriptions of imported electrical accessories to bear an indication of origin. This order covers lampholders, ceiling roses, adaptors for lampholders, switch plates, articles up to and including 30-A rating of the following descriptions: Switches, cut-outs, fuses, wall sockets, plugs for wall sockets, plugs and sockets for use as connectors to portable or mobile appliances, and plug adaptors for wall sockets. The indication of origin shall be applied as follows: (*a*) Die-stamped, impressed, embossed, engraved or moulded on each article, provided that in the case of cartridge fuses less than ½ in. in diameter and 2 in. in length and switch plates of glass it shall be a sufficient compliance with this requirement if the indication of origin is stamped or printed on a label securely affixed to each article; and (*b*) stamped or printed on any carton or other container in which the goods are sold or exposed for sale. The goods affected need not be marked at the time of importation, but must bear the specified marking upon exposure for sale. The Order will come into force at the expiration of three months after the date thereof (November 10th).

E.D.A. Christmas Window Displays

The British Electrical Development Association has issued a publication (E.D.A. 1200) illustrating four special Christmas window displays which it has prepared. These displays have been designed to attract customers who wish to give their home a practical electrical gift, to emphasise their intrinsic and practical value, and to demonstrate that such gifts can be used by every member of the family. The displays are moderate in price and each is accompanied by a suggested colour-lighting plan. Members of the Association who desire a special Christmas window can obtain a design by submitting a ground plan of the window dimensions.



Two of the special Christmas window displays designed by E.D.A.

The Kitchen Competition

The Association has now issued a pamphlet (E.D.A. 1202), which gives full particulars of the competition in electric kitchen design, for which prizes of £50 and £25 respectively in each of the two classes are offered. The designs, which must be received at the Association's offices by January 15th, are to be for decoration, equipment, fixtures and fittings for the complete interior of kitchen-sculleries of the following sizes:—Design 1: House net cost £300-£400; maximum superficial area 80 sq. ft. Design 2: House net cost £800-£900; maximum superficial area 110 sq. ft. A ceiling height of approximately 8 ft. clear is to be taken. A short report describing the novel features or other details of fittings and decorations should accompany the design, and competitors may submit more than one design. Entries will be judged according to the workmanlike arrangement of the kitchens, special attention being paid to good arrangement of sink and fixtures, as well as electrical appliances from the point of view of compact design, labour and step-saving, good posture, general economy and appearance. The assessors will be Messrs. R. S. Downe (Brompton & Kensington Electricity Supply Co.), F. Lorne (Sir John Burnet, Taite & Lorne), L. G. Pearson (Messrs. Adams, Holden & Pearson), A. C. Cramb (E.D.A.), and Miss Maughan (National Society's Training College of Domestic Subjects).

Employment During October

There was a further general improvement in employment in the engineering industry during October, according to the *Ministry of Labour Gazette*, although the industry continued slack on the whole. The number of unemployed fell to 189,961, reducing the proportion from 21.3 to 19.9 per cent. (in October, 1932, the figure was 27.5 per cent.). In the electrical engineering section the number of unemployed was 11,114 and the proportion fell from 13.0 to 12.3 per cent. (16.0 per cent. in October, 1932). There was a slight improvement in the electric cable, apparatus and lamp manufacturing group, the unemployment total being 11,956, and the percentage falling from 10.3 to 9.5 (10.5 in October, 1932). The electrical wiring and contracting industry was also a trifle better; the total number of unemployed was 4,300 and the percentage fell from 16.8 to 15.6 (17.5 in October, 1932).

The Dunoon Electrical Exhibition

An electrical exhibition held by the Dunoon and District Electricity Supply Co., Ltd., was opened on Monday last in the Pavilion, Dunoon, by Provost Stewart. Mr. C. Stewart, in introducing the Provost, said the company wanted to supply electricity at the cheapest possible rate, and he believed that this was the only way to the "all-electric" home. The company did not tap off the national grid, but he was very gratified to know that its Diesel plant was capable of supplying power for domestic use at the low running charge of 1d. per kWh. together with a fixed basic charge. The chairman of the company, Mr. G. Leslie Wates, said that the exhibition would demonstrate how cheap it was to use electricity for every possible domestic purpose. The resident engineer and manager of the Dunoon Company is Mr. H. J. Wright, and associated with him is Mr. J. C. Mitchell. The following are represented at the exhibition which closes to-morrow (Saturday): Beatty Bros., Ltd.; British National Electrics, Ltd.; Brown & Jepson; Carron Company; Edison Swan Electric Co., Ltd.; Film Industries; Johnson & Phillips, Ltd.; James McGregor; Simplex Electric Co., Ltd.; Thermovent, Ltd.

Bristol Electrical Contractors

The Bristol Branch of the Electrical Contractors' Association is holding its annual dinner and dance on January 24th at the Grand Hotel, Broad Street, Bristol. Applications for tickets (dinner and dance combined, ladies 7s. 6d., gentlemen 10s. 6d.; dancing only, single tickets 6s., double tickets 10s.) should be made to Mr. S. A. Leathers, branch hon. secretary, 8, Clare Road, Victoria Walk. Cotham, Bristol.

Artificial Daylight for Display Purposes

An illustration on the next page shows part of the lighting installation at the premises of Messrs. Shanks & Co., Ltd., New Bond Street, W.1. The products displayed are bathroom fittings, &c., employing many combinations of coloured tiles. In order that these tiled surrounds should be seen in their true colours it was decided to install artificial daylight as the illuminating medium. The fittings chosen were G.V.D. in-

direct sunlight pendants manufactured by G.V.D. Illuminators, Aldwych House, W.C.2. This room was lighted previously by uncorrected light having a total wattage of 2,880. In the present installation the wattage is 1,880. The evenness of the

Artificial daylight in a West End showroom

distribution of the light will be noticed and also the absence of halation round the bowl of the fitting.

Registered Electrical Contractors

Applications for registration from the following were accepted by the executive committee of the National Register of Electrical Installation Contractors at its last meeting :—

Byrne, J. C., Moss Side, Manchester.
Beard, S. J., Stourport.
Colman, F., Hr. Crumpsall, Manchester.
Bleasdale, S., & Co., Maghull, Lancs.
Jephcott & Challis, Hull.
Lee, S. & M., London, E.1.
Truswell, Wm., & Son, Newcastle, Staffs.
Waddington, A., Rochdale.
Electrical Contracting Co., Walsall.
Hardy, A., Hull.
Barnes, Southsea, Hants.
Dow, Wm., & Sons, Ltd., Kilmarnock.
Magoris & Co., Hull.
Acorn Electrical Co., Ltd., London, W.3.
Ashworth Bros., Manchester.
Tooth, Geo., & Son, Eccles.
Brader, G. H., Fallowfield, Manchester.
Frankish & Bell, Manchester.

At the same meeting three applications were withdrawn and six were declined.

Street Lighting at Cheadle

The accompanying illustration shows the High Street, Cheadle, Ches., which has been illuminated by "Polygon" lanterns manufactured by the Wardle Engineering Co., Ltd. This street-lighting contract has recently been completed, and more than 170 of these units have been installed under the supervision of Mr. R. W. Willis, the electrical engineer and manager of the Urban District Council's electricity undertaking.

Social Events

On Thursday last we had the pleasure of witnessing another performance by the G.E.C. Dramatic Society, the play chosen on this occasion being Sir James Barrie's "Dear Brutus," which was given at the Conway Hall, Red Lion Square, W.C. The play is one which most amateurs wisely avoid, as it abounds in pit-falls, and calls for extreme delicacy of touch. The Society is to be congratulated on a plucky attempt, from which it has no doubt gained valuable experience. After a slight suspicion of "nerves" in the opening scene, the company settled down to give a very creditable performance, which, in the second and last acts, reached a high standard. That it pleased the large audience was obvious from the enthusiastic applause accorded at the fall of the final curtain. The performance was repeated on the following evening. The cast included Messrs. D. Pearmain, D. Murdoch, J. Hart-Davis, W. Avenell, and H. Castledine, and Mesdames C. Needham, E. Whiting, N. Symonds, E. Richardson, K. Walters, and C. Ridler.

The eighth annual staff dinner and dance of the Lancashire Electric Power Company which took place at the Grand Hotel, Manchester, last Friday, was one of the most successful yet held. Mr. C. D. Taite, engineer and manager, and other members of the executive were present, and the company included more than 200 of the staff and their friends, who had come from all parts of the company's area. Dinner was served in the ballroom, which was very effectively lighted by means of a new electrical installation. After dinner the room was cleared for dancing, which lasted until the "wee sma' hoors," when special transport facilities conveyed members back to their respective points of duty in the area.

Over 500 people assembled at the Hotel Great Central, Marylebone, on Saturday last on the occasion of the annual staff dinner of W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre and Rubber Co., Ltd. The chairman of Henley's, Sir Montague Hughman, presided, supported by directors and heads of departments of both companies. During the evening a telegram of greeting was sent to Sir George Sutton, the president, who was unable to attend, and a reply was received from him later. Dr. P. Dunsheath proposed the toast "W. T. Henley's Telegraph Works Co., Ltd.," and said that the company's success was reflected in the steady rise in the value of its ordinary shares during the past few years. He thought that pessimism was totally unjustified. So well had the company weathered the depression that when the revival came it would easily be in the forefront. The growth of electricity supply showed that the industry was sound and had a great future. Mr. A. W. Ray, in submitting the toast of the Tyre Company, said that they had sold more tyres during the first ten months of this year than in the whole of 1932. Sir Montague Hughman replied to both toasts. He referred to the loss which the company had sustained through the deaths of Messrs. W. J. Potter, A. E. Salmon and R. J. Hatten; he welcomed the new directors, Sir Maurice Simpson and Messrs. Bishop and Lamont. He playfully mentioned that it was his aim to foster the "human" touch in the company and said that the company's books showed a greater value of orders on hand than at this time last year. He paid a tribute to Mr. B. C. Wilkins, chairman of the dinner organising committee, who made a brief acknowledgment. During the dinner a penny collection was made for the E.I.B.A., which resulted in a total of £3 17s. 8d.

The dinner was followed by a dance in the Winter Garden, for which Mr. H. Stanley, the toastmaster, acted as M.C.

The Lewcos Staff Dramatic Society (London Electric Wire Co. & Smiths, Ltd.), is presenting "The Whole Town's Talking," by John Emerson and Anita Loos, at the Guildhall School of Music, John Carpenter Street, E.C., this evening (Friday).

Ever Ready Window Display Competition

The Ever Ready Co. (Great Britain), Ltd., has announced the results of its recent window display competition. Four special prizes of £30 each have been awarded to Munt's, Stonehills, Welwyn Garden City; E. V. Lomas-Smith, Camberley; Seal & Ball, Ltd., Southport, and Marshall Bros., Moseley, Birmingham. In addition, the company has awarded thirty-two prizes of £20 each and sixty-four prizes of £5 each to various dealers in the Southern and Northern Counties, Midlands, Scotland, Wales and Ireland.

A Continental Radio Valve Cartel

Efforts are being made on the European Continent to constitute a cartel to control the markets in radio valves in a manner similar to that which is practised in the lamp industry. The negotiations have been proceeding since the spring of this year between, among others, representatives of the German Telefunken Co. or the Verband der Funkindustrie on the one hand, and the owner of the third largest works for lamps and radio valves in Europe on the other, the United Glow Lamp and Electricity Co. of Budapest (Ver. Gluhlampen und Elektricitats, A.G.). The latter company is connected with the Standard Electric Co. and the United States General Electric Co.

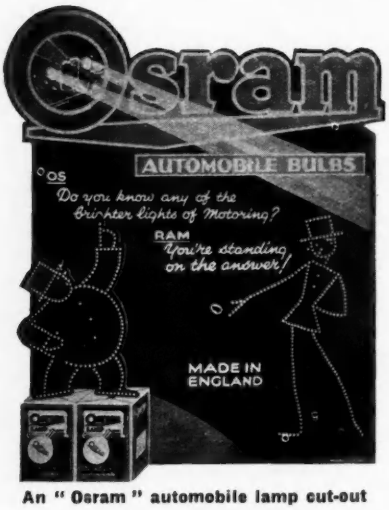
Wardle "Polygon" lanterns at Cheadle

The failure of negotiations between the German wireless valve interests and the Hungarian company in October last, according to the *Frankfurter Zeitung*, was mainly due to the share which was demanded by the Hungarian company in the

suggested cartel for the regulation of the export trade in radio valves. Thereupon the latter company, facilitated by the expiration in Germany of the Lieben valve patents, at once entered the German market with its special type of valve known as the "Tungsram." It is thought that this thrust of the Hungarian company, after having previously entered the markets in Belgium, France, Holland, and Switzerland (where the patent rights situation is not so difficult as in Germany), may also have as its object the obtaining of a larger quota in the international cartel, which is still expected to be formed, than the particular share which the German makers offered prior to the breaking off of the negotiations.

Automobile Lamp Publicity

The accompanying illustration shows a cut-out which the General Electric Co., Ltd., has designed to advertise "Osram" automobile bulbs. This cut-out is being distributed for display in motor garages and electrical dealers' establishments. It uses the company's popular "Os" and "Ram" design.



An "Osram" automobile lamp cut-out

Northmet Publicity

The North Metropolitan Electric Power Supply Co. has issued a broadsheet illustrating suggested electrical Christmas gifts. These include lamp standards and shades, electric fires, clocks, decorative lamp outfits. We have also received a copy of the company's calendar for 1934. This consists of monthly sheets, each containing an excellent illustration in bright colours, reproduced from specially painted water colours by Messrs. F. Gardner, E. Howarth and J. Gardner, of various places in the company's wide area of supply.

Soldering Iron Display

Small tools and appliances do not usually lend themselves to effective window displays, but the picture on the next page of a display of "Solon" electric soldering irons, made by W. T. Henley's Telegraph Works Co., Ltd., in the showrooms of Worthing Corporation Electricity Department shows how this difficulty can be overcome. The background consists of a series of screens decorated in blue with a border of white and red which is "zig-zagged" so as to convey a suggestion of electricity and at the same time is designed so as to draw the eye to the central feature of the display, a full size figure of a "handyman" using a "Solon" soldering iron. Closer interest is secured by an H.M.V. wireless set chassis showing the soldered connections.

Recent Contracts

Messrs. Gent & Co., Ltd., have received an order for the supply of electrical chiming and striking gear for the King

Gent electric chiming gear for the King of Egypt

of Egypt (King Fuad) to the Palace, Alexandria. The set of chimes, consisting of eight tubes, has a total weight of 1,323 lb., the striking tube weighing 253 lb. The tune played is W. L. Vipon Barry's St. Bartholomew's Chimes, and the tubes are struck by electrically operated solenoids controlled from a commutator. In addition to the striking and chiming apparatus, there are four 5 ft. 9 in. exposed dials operated by a "Pulsynetic" waiting-train movement. The apparatus is shown in the accompanying illustration.

A Christmas Showcard

The accompanying illustration is of a special showcard which Messrs. Peto & Radford have prepared for the Christmas trade. This card, which is printed in red, black, green and white, is available to all radio dealers, and suggests a "Dagenite" accumulator as a Christmas gift.

A "Dagenite" accumulator showcard

An Electrical Installation Contract

The Lincolnshire Joint Board for the Mentally Defective invites registered electrical contractors to apply for inclusion in a list of firms to tender for the electrical installation at the Harmston Hall Colony (see our classified advertisements).

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, November 22nd.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£3	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3⅜d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. less 6 per cent.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti friction Metals—		
Grade I ... ... per ton net	£204	£1 inc.
Grade II ... ... ,,	£140	£1 inc.
Grade III ... ... ,,	£69	£1 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	6¼d.	¼d. dec.
c ,, Tubes (solid drawn) ... ... ,,	8¾d. to 9d.	¼d. dec.
c ,, Wire, basis ... ... ,,	7¾d.	¼d. dec.
c Copper Tubes (solid drawn) ... ... ,,	9¾d.	¼d. dec.
g ,, Bars (best selected)... ... per ton	£60	£2 dec.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		—
d ,, (Electrolytic) Bars ... ... ,,	£42	—
d ,, ,, Sheets ... ... ,,	£64	—
d ,, ,, Wire Rods ... ... ,,	£42 10s.	£1 10s. dec.
d ,, ,, H.C. Wire ... per lb.	6¼d.	⅛ d. dec.
f Ebonite Rod ... ... ,,	1/3 to 1/6	—
f ,, Sheet ... ... ,,	1/3 to 1/6	—
n German Silver Wire ... ... ,,	2/2	—
k Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	4¼d.	¼d. inc.
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual. ,,	£20	—
g Lead, English Pig ... ... ,,	£12 15s.	10s. dec.
g Mercury ... ... per bot.	£9 15s. to £10	—
e Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11d.	—
p ,, ,, rolled strip & sheet ,,	11d.	—
p ,, ,, wire ... ... ,,	11¼d.	¼d. dec.
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	8d.	⅛d. dec.
r Steel, magnet, in bars ... ... ,,	7¼d.	—
n Tin, Block (English)... ... ... per ton	£228 5s. to £230 5s.	£3 inc.
g ,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. R. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notices" under the same heading.

New Catalogues and Lists

Bastian & Allen, Ltd., 12 and 14, Church Road, Hanwell, W.—A leaflet giving the actual cost of running up to the season 1932-33, of sixteen different electrode boiler installations, together with a brief description of each.

Hailwood & Ackroyd, Ltd., Morley, Yorks.—A 16-page catalogue of "Hailware" cube-shaped pendant fittings, the majority of which are new introductions.

B. B. Fenn, Homefield House, Raymead Road, Maidenhead.—A card giving particulars of the "Color-o-Graph" electric lamp.

C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne.—Leaflets Nos. 47 and 50 drawing attention to Parsons mechanical speed-reducing gears and water-gauge projector.

W. T. Henley's Telegraph Works Co., Ltd.—A folder describing the "Holborn" cold-jointing tape, together with a business reply card.

A display of "Solon" soldering irons

W. Crockatt & Sons, Ltd., 62 and 64, Darnley Street, Glasgow, S.1.—A booklet fully describing the "Crockatt Simplex" patent electric salinometer for indicating any impurities in the condensate with a list of users of these instruments.

Z Electric Lamp & Supplies Co., Ltd., 21, Newman Street, W.1.—An illustrated catalogue of radio receivers, radio-gramophones, electric fires and clocks.

National Gas & Oil Engine Co., Ltd., Ashton-under-Lyne.—The November issue of the "National Bulletin" describing a "National" oil engine installation at the Palace Cinema, Hanley, and a gas engine installation for the Coatbridge sewage scheme.

Nuway Electrical Accessories Co., 224, Fulham Palace Road, Hammersmith, W.6.—A folder describing the "Nuway" lampholder with an automatic locking device.

C. W. Outram & Co., Ltd., Woodville, near Burton-on-Trent.—An illustrated list of vitreous porcelain accessories, insulators, &c.

Erskine, Heap & Co., Ltd., Caroline Street, Salford, Manchester.—Pamphlet O.B.3, illustrating, with brief particulars, an 11,000-V inverted pole-mounting trifurcating box which the company has recently put on the market.

Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, W.C.—The second edition of the Mullard valve guide (pages 96), which has been revised and brought up to date.

Brown Bros., Ltd., Great Eastern Street, E.C.2.—The third of a series of electrical lists (No. 369) illustrating modern and period lighting fittings.

East London Rubber Co., 29/33, Great Eastern Street, E.C.2.—A comprehensive catalogue (pages 128) of electrical fittings, fires, domestic appliances, vacuum cleaners, &c.

S. Russell & Sons, Ltd., Bath Lane, Leicester.—Leaflets relating to special alloy cast irons.

Arthur Gray, Ltd., 150, Charing Cross Road, W.C.—A 1934 catalogue of radio receivers, and a net trade list of electrical accessories.

Brook Motors, Ltd., Empress Works, Huddersfield.—List No. 346 containing dimensions, specifications, &c., of "S" type motors, and No. 359 relating to small single-phase motors from ¼ to 10 h.p.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.—Publication No. C.L.928 of artistically designed lamp shades in imitation vellum, "Rhodoid," "Cellon," "Peerlix," "Crystalux," &c.

London Electric Firm, Brighton Road, South Croydon.—Stock lists of electrical and engineering materials, and of dynamos, motors, &c.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Publication No. 6820 giving illustrated particulars of battery-charging switchboards, rectifying units, and air-break circuit-breakers.

Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, W.—An illustrated catalogue (BST9/33) of battery shop tools and equipment.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Publication No. SF.88B describing "Aeroto" fans for auxiliary mine ventilation.

Kandem Electrical, Ltd., 711, Fulham Road, S.W.—A leaflet containing illustrated particulars of daylight fittings for colour matching, &c. Also the October issue of the "Kandem Quarterly Review."

E. Shipton & Co., Ltd., Caxton House, Tothill Street, S.W.—An illustrated leaflet relating to a new inter-dial telephone for interhouse use.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.—A folder (No. 6709) illustrating electrical gifts for Christmas.

Bankruptcy Proceedings

H. Mozer and **S. Mozer,** trading as H. & S. Mozer, radio dealers, 111, High Street, Stoke Newington, N.—These debtors attended on November 17th before Mr. Registrar Mellor at the London Bankruptcy Court for public examination upon accounts showing liabilities of £1,046 against assets £65. In reply to Mr. Bruce Park, Assistant Official Receiver, the debtors stated that in April last they offered a composition of 2s. 6d. in the £, but it was not unanimously accepted, and the petitioning creditors instituted these proceedings. The examination was concluded.

R. F. Palmer, electrical engineer, 19, Church Street, Burnley.—Receiving order made November 14th on debtor's own petition.

E. Blackmore, electrician, 33, Monmouth Road, Dorchester.—Last day for receiving proofs for dividend, December 1st. Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver.

R. S. Wright, 33, Broomfield Road, Coventry, radio dealer.—This debtor filed his own petition recently, and has lodged a statement of affairs showing gross liabilities of £527, of which £511 is expected to rank for dividend, and net assets of £39, leaving a deficiency of £472. He attributes his failure to heavy overhead expenses, bad debts and competition.

A. G. L. Pennock, wireless and electrical dealer, 59, Primrose Hill Street, Coventry.—Hearing of application for discharge adjourned *sine die*.

J. H. McBean (H.W.D. Battery Co.), electrical engineer, 29, Bradford Road, Batley Carr.—Discharge suspended for two years until October 17th, 1935.

P. M. Braidwood, electrical engineer, "Holmwood," Lyonsdown Road, New Barnet.—Trustee, Mr. W. Boyle, Senior Official Receiver, Bankruptcy Buildings, Carey Street, W.C., released October 31st.

J. G. M. Hilton, electrical engineer, 103, Exchange Buildings, Birmingham.—Last day for receiving proofs for dividend November 29th. Trustee, Mr. C. Hoult, 159, Great Charles Street, Birmingham, Official Receiver.

V. F. Maddox, electrical and wireless engineer, 6, Homend Street, Ledbury.—Last day for receiving proofs for dividend November 29th. Trustee, Mr. O. B. Wallis, 133, St. Owen Street, Hereford, Official Receiver.

B. Roberts (Auto Electrical Co.), electrical engineer, 89, Tydraw Street, Port Talbot.—Last day for receiving proofs for dividend November 30th. Trustee, Mr. A. J. Rogers, Government Buildings, St. Mary's Street, Swansea, Official Receiver.

Company Liquidations

A. E. Durn & Co., Ltd., electrical contractors, 59, North Street, Romford.—Under the compulsory liquidation of this company the statutory first meetings of the creditors and shareholders were held on November 14th at Carey Street before Mr. Hutcheson, Assistant Official Receiver. The accounts showed liabilities of £1,029 and assets of £381. The chairman reported that the company was incorporated in 1929 with a nominal capital of £1,000 to acquire as a going concern the business of electrical contractor and wireless dealer previously carried on by A. J. Durn at the above address under the style of A. E. Durn & Co. On March 1st, 1932, a debenture for £250 was issued to Durn in lieu of the £350 cash consideration, and on May 11th, 1933, a receiver and manager was appointed on behalf of the debenture holder. The chairman observed that the debenture holder's receiver had sold the goodwill and benefit of contracts for £50 and the stock, fittings, &c., for £200. There was little prospect of any dividend being paid to the unsecured creditors. The Official Receiver was left in charge of the liquidation.

Lotus Radio, Ltd.—Particulars of claims by December 18th to Mr. W. T. Wood, 3, Lord Street, Liverpool, or Mr. F. C. Marsh, 3, Rumford Street, Liverpool, joint liquidators.

Peter Jones, Ltd.—Winding up voluntarily with a view to amalgamation with Messrs. John Lewis & Co., Ltd. Liquidator, Mr. F. S. S. Tull, 3, Frederick Place, Old Jewry, E.C.

Darlington Forge Co., Ltd.—Winding up for reconstruction purposes. Liquidator, Mr. E. J. Waddington, Vickers House, Broadway, S.W. This notice is purely formal and all creditors will be paid in full. Meeting, December 19th, at Vickers House, to receive an account of the winding-up by the liquidator.

Junit Manufacturing Co., Ltd.—Particulars of claims by November 30th to the liquidator, Mr. C. H. Nathan, Norfolk House, Norfolk Street, W.C. Meeting, December 18th, at Norfolk House, to receive an account of the winding-up by the liquidator.

Clear Radio, Ltd.—Winding up voluntarily for reconstruction purposes.

T. S. Armstrong & Co., Ltd.—Particulars of claims by December 9th to the liquidator, Mr. T. Bell, 53, Grey Street, Newcastle-on-Tyne.

Erith Battery Co., Ltd.—Particulars of claims by November 30th to the liquidator, Mr. L. G. Percival, Markham, Oaklands Avenue, West Wickham, Kent.

Dynic International Radio, Ltd.—Meetings December 15th at 64, Victoria Street, S.W.1, to receive an account of the winding-up by the liquidator, Mr. H. A. Kellie.

H. Sayner, Ltd.—Meetings December 21st, Glenroyal Cinema, Briggate, Shipley, to receive an account of the winding-up by the liquidators, Messrs. T. Luxton and A. Cripwell.

Radio Service (Nelson), Ltd.—Meetings December 14th at 46, Carr Road, Nelson, to receive an account of the winding-up by the liquidator, Mr. J. H. Priestley.

Jacobs & D'Rane, Ltd.—Meeting December 14th at Donington House, Norfolk Street, Strand, W.C., to receive an account of the winding-up by the liquidator, Mr. A. W. Mann.

Sea Houses and District Electric Supply Co., Ltd.—Meeting December 9th at the Bamburgh Castle Hotel, Sea Houses, to receive an account of the winding-up by the liquidator, Mr. W. Sparks.

Dissolution of Partnership

Supreme Radio Services, wireless engineers, Alcester Road, Studley.—Messrs. C. V. Clayton, L. K. Wainwright, and Phyllis Evelyn Wainwright have dissolved partnership. Mr. Clayton will carry on the business.

Electricity Supply

Lighting, Domestic, Power

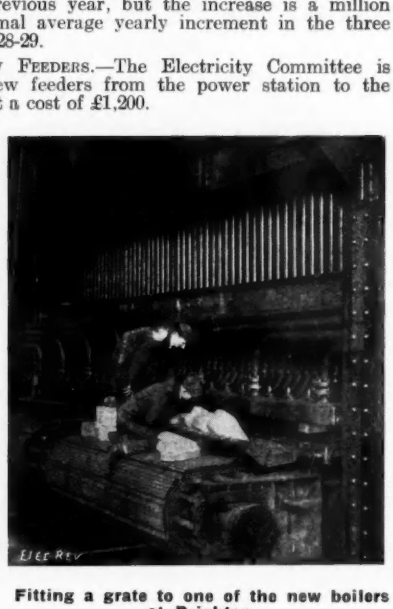
Aspatria (Cumberland).—ELECTRICITY FOR COUNCIL HOUSES.—The Council has agreed to install electricity in 52 houses on the housing estate at a cost of £4 14s. per house.

Australia.—VICTORIA ELECTRICITY COMMISSION'S REPORT.—According to the annual report of the Auditor-General the Victoria Electricity Commission made a net profit for the year 1932-33 of £3,429. On electricity supply there was a profit of £353,507.

EXTENSIONS AT YALLOURN.—The Victoria Electricity Commissioners are considering the installation at Yallourn power station of an additional 25,000-kW generating set, together with steam-raising plant. It is regarded as necessary that this should be ready by the winter of 1935, in order to ensure continuity of supply and a reasonable proportion of reserve plant. Since 1928 the Commission has spent £1,217,000 on major extensions to the power house, and but for the depression, which restricted the demand for energy, would have spent £2,100,000. Under the 1928 scheme the first of three new 25,000-kW sets was to be in operation by the winter of 1931, the second by 1932, and the third by 1933. The first was not installed until 1932. The second set has not been installed yet, but the recovery in demand in the last two years is sufficient to warrant its consideration. In the year 1932-33 the sales of electricity increased by about 35,000,000 kWh compared with the previous year, but the increase is a million less than the normal average yearly increment in the three years preceding 1928-29.

Blackpool.—NEW FEEDERS.—The Electricity Committee is to provide two new feeders from the power station to the pumping station at a cost of £1,200.

Brighton.—NEW 30,000-kW SET.—The erection of the new Parsons 30,000-kW (37,500-kVA) 3,000-r.p.m. turbo-alternator with its Babcock & Wilcox boilers at Southwick power station is nearing completion, as the photographs reproduced on p. 737 indicate. Steam conditions will be 600 lb. per sq. in. and 850 deg. F. The overall length of the turbo-alternator is 53 ft. 6 in., and the total weight 350 tons. A ⅛-scale model is being exhibited in the window of Brighton Corporation's electricity showrooms. The new plant was built to the specification, and is being installed under the supervision, of Mr. W. N. C. Clinch, borough electrical engineer and manager.



Fitting a grate to one of the new boilers at Brighton

Broadstairs.—NO REDUCTION IN CHARGES.—The Isle of Thanet Electric Supply Co., Ltd., has informed the Urban District Council that it is not prepared to reduce the charges for electricity in the urban district unless the Council is willing to discuss proposals for the extension of the company's tenure, which expires in 1941. The matter is to be further considered by the Lighting Committee.

Bromley.—SUPPLY TO CUDHAM.—As a result of a recent inquiry at Orpington, regarding the application of the West Kent Electric Co. to place overhead cables in the district for a supply of electricity to Cudham, the Minister of Transport has informed the Rural District Council that he has decided to consent to the application, but reserves the right to review the position after five years.

Burnley.—SUPPLY FROM GRID.—From November 22nd the electricity undertaking will take temporary supplies from the Central Electricity Board until the end of the year. This will enable the department to meet any extra demand until the town is definitely linked up with the grid in January. Supplies will then be taken up to a maximum of 10,000 kW.

Carnforth.—ELECTRIC STREET LIGHTING.—A supply of electricity was commenced on November 8th, and will be used for street lighting on a loan being sanctioned by the Ministry of Health. The supply to Warton will be available in a few months.

Dorchester.—CANVASS.—The borough electrical engineer is to canvass High Street, Fordington, with a view to obtaining additional consumers in that district.

Dumfries.—TWO-PART TARIFF.—The Corporation is offering a two-part tariff to the County Council for the supply of electricity to schools and other buildings where current for heating and cooking is used.

Dundee.—SPECIAL ORDER.—Application has been made by the Corporation for a Special Order to authorise the undertakers to "supply and distribute electrical energy within so much of the City of Dundee as constituted at the commencement of this Order which prior to the coming into force of the Dundee Corporation Order, 1932, formed part of the County of Angus."

Ealing.—FLOODLIGHTING.—The Electricity Committee has agreed to supply Messrs. John Sanders, Ltd., with current for floodlighting at a flat rate of 2d. per kWh subject to current being consumed by each installation for not less than 800 hours per annum, and with electricity for shop-window lighting after closing time at one-half the usual lighting rate subject to the consumption of current for not less than two hours per evening during eight months of the year.

Egypt.—NEW STEAM STATION.—A new steam-operated power station has recently been built by the Egyptian Government at Edfu, in Upper Egypt, halfway between Luxor and Assouan, its purpose being to irrigate a part of the country which is still a desert. At Edfu, the Nile flows between steep banks so that the water must be pumped up from 10 to 32 ft., according to the level of the river, by twelve pumping stations containing centrifugal pumps driven by electric motors. A further five pumping stations are also planned to drain water from marshy regions near the Nile. The complete mechanical and electrical equipment of the Edfu power station was supplied by the Brown, Boveri Co. Two 2,500-kW turbo-generator sets form the first development stage, but a third unit is to be added later. Each turbo-set has its own water-tube boiler with superheater, economiser, and furnace adapted for firing with pulverised coal or fuel oil. The turbines are of Brown-Boveri standard two-cylinder type built for a steam inlet pressure of 426 lb. per sq. in. absolute, and a temperature of from 662 to 758 deg. F. The turbines run at 3,000 r.p.m. and are directly coupled to 3,300-V 50-cycle three-phase alternators. The main auxiliary services can be supplied in emergency with power by a 250-h.p. Diesel engine directly coupled to a 166-kW, 230-V three-phase generator. For power transmission purposes two 4,000-kVA main transformers have been installed to step up the generator voltage from 3,300 to 33,000 V.

Municipal Supply Undertakings' Results, 1932-1933

District.	Engineer.	Total Revenue. 1931/32.	Total Revenue. 1932/33.	Working Expenditure. 1931/32.	Working Expenditure. 1932/33.	Net Profit or (*) Loss. 1931/32.	Net Profit or (*) Loss. 1932/33.	Sales of Electricity. 1931/32.	Sales of Electricity. 1932/33.
		£	£	£	£	£	£	kWh.	kWh.
Bridlington...	A. J. Beckett	34,195	34,912	18,212	20,780	7,235	3,173	2,028,298	2,271,371
Haslingden	P. Clegg	20,961	24,132	13,818	16,181	1,442	1,776	—	—
Lytham St. Annes... ...	J. C. Fairchild	76,981	79,578	41,672	45,737	2,197	4,201	8,071,864	8,518,671
Liverpool	P. J. Robinson	1,446,212	1,493,628	688,889	770,170	94,486	94,958	297,024,887	310,275,371
Motherwell	W. D. Brassington ...	—	69,422	—	51,890	—	—	8,6 5,504	10,647,160
Nelson	T. Dawson Martin ...	86,655	94,757	40,507	63,837	1,605	2,581	14,287,783	15,305 461
Newport	A. Nichols Moore ...	196,434	200,662	100,836	97,917	339	6,104	40,190,550	45,309,670
Norwich	V. A. Pask	266,484	285,035	145,947	157,379	24,159	25,252	2,941,608	4,078,854
Oldham	F. L. Ogden	271,669	287,409	143,151	151,513	10,978	10,516	62,482,100	64,395,000
Preston	J. F. Simpson	325,923	349,421	147,914	162,714	4,176	2,399	109,225,211	131,775,948
Rawtenstall	J. E. Shepherd	67,856	67,414	41,811	42,154	3,775	3,288	14,344,320	13,480,663
Salford	L. Romero	326,187	334,354	151,807	155,291	40,120	37,575	69,338,785	75,954,995
Sheffield	E. Morgan	882,937	961,019	449,361	476,844	102 229	139,398	207,861,395	228,021,318
Southampton	W. G. Turner	301,838	307,315	147,452	151,824	21,774	20,970	43,771,825	47,466,987
South Shields	J. Edgar	110,108	115,161	54,961	53,952	7,368	6,648	10,761,812	11,247,463
Stafford	W. H. Robins	55,516	53,863	41,670	39,261	3,249	5 569	9.449,581	9,873,824
Stalybridge...	J. Harwood Lumsden ...	134,730	145,415	73 392	71,960	11 686	17,089	40,995,878	41,544,778
Stepney	W. C. P. Tapper	408,984	417,704	194,307	193,161	7,245	13,830	77,137,016	77 091,274
Stirling	W. R. Murray	—	22,559	—	16,106	—	1,374	2,233,301	2,573,152
Stretford	T. A. Kerr	255,625	252,423	180,704	169,961	*13,482	*2,590	79,689,700	76,589,833
Tynemouth...	C. Turnbull	65,417	65,715	43,507	42,744	2,632	3,317	8,200.221	8,144,748
Wallasey	B. T. Hawkins	179,138	188,674	97,388	99,895	24,476	33 401	56,173,689	60,586,807
West Ham	J. W. J. Townley ...	439,5 .6	461,666	251,265	254,216	22,417	27,384	112,601,471	117,662,020
Weymouth	G. Nicolson	43,238	46,472	21.310	22,169	6,371	6,902	4,156,384	4,703,133
Willesden	A. W. Blake	249,351	257,961	175,837	193,219	9,131	3,165	40,559,064	43,793,565
Winchester	R. Ayton	38,572	40,780	23,435	23,385	556	1,962	2,841,653	3,113,563
Yarmouth	P. E. Rycroft	132,877	138,633	45,939	50,233	8,103	11,413	15,122,347	17,908,301

Sales of electricity in 1932/33 include in certain cases supplies given to the Central Electricity Board.

From the transformers, a double overhead line is carried over the River Nile to the Ramadi canal; from there a single line runs north to Sibaija to supply five future pumping stations, while another single line goes south to Silwa-Nord. The Nile is again crossed at this point and the line carried along the other bank to Daraw, supplying twelve pumping stations.

Elham (Kent).—SUPPLY TO HAWKINGE AND LYMPNE.—With reference to the supply of electricity to Hawkinge and Lympne, the Rural District Council has decided to arrange a conference with representatives of the Folkestone Electricity Co., and the Electricity Committee at Ashford. Difficulties have arisen regarding the supply by overhead lines owing to the aerodromes in the vicinity.

Gamlingay.—ELECTRICITY SUPPLY.—A supply of electricity will shortly be available in Gamlingay and the Council is to consider the advisability of installing electric street lighting.

Glasgow.—MAINS EXTENSIONS.—The Electricity Committee has agreed to the laying of distributing mains at a cost of £3,740.

Great Yarmouth.—ILLUMINATIONS.—The Electricity Committee has decided to continue the strip lighting on the Marine Parade from Euston Road to Salisbury Road (£288) and from Wellington Pier to the pleasure beach (£160).

Helensburgh.—LOAN.—The Town Council is to borrow £1,000 for mains, services and meters.

Kettering.—ELECTRICITY EXTENSION.—The Urban District Council has received sanction to the borrowing of £45,000 in connection with the provision of a supply of electricity to Messrs. Stewarts & Lloyds, Ltd., at Corby, and the loan is to be raised. The maximum demand anticipated is 2,000 kW at the date of commencement of supply. Work is to start immediately on the erection by the Urban District Council of the 33,000-V overhead line from Kettering to Corby, and it will be finished by the beginning of next year. Seven cables will be carried by the towers, but they will run underground from Kettering electricity works to a new sub-station which is to be built in Rothwell Road. From there the lines will be overhead. To enable the Kettering plant to deal with the increased demand, another overhead line is to supply current to the works from the Birmingham grid. It will approach Kettering from the Northampton direction, *via* Pytchley. The contractors for the Kettering-Corby line are Messrs. W. T. Henley's Telegraph Works Co., Ltd.

LOANS.—During the next three years £20,000 is to be borrowed for the following unspecified purposes: Meters, £10,000; conversion of consumers' apparatus, £5,000; and sub-station equipment, £5,000.

Lamberhurst.—SUPPLY PROPOSED.—The Weald Electricity Supply Co., Ltd., is taking steps to extend its supply to Lamberhurst, partly by underground cables.

Lichfield.—LOAN SANCTIONED.—The City Council has received sanction to a loan of £1,654 for extending the mains to Streethay.

London.—BATTERSEA.—The Electricity Committee is to provide electricity to the premises of Messrs. Aplin & Barrett, Ltd., Elcho Street, at a cost of £400, and alter mains at the premises of Messrs. Morgan Crucible Co., Ltd., in Church Road, at a cost of £522. The Committee is also to provide electricity services to 218 premises at a cost of £1,931.

WESTMINSTER.—The Housing Committee is to install electric lighting at the stairs and yards of dwellings on the Millbank estate at a cost of £555.

SHOREDITCH.—The Electricity Committee recommends that the rate for external lighting and electric signs be reduced from 3½d. per kWh less 10 per cent. to 2½d. per kWh.

Lowestoft.—EXTENSION.—The Town Council is to extend the h.p. line at Lowestoft Road, Carlton Colville, in order to supply electricity to about 150 houses in the vicinity.

Macao.—RECONSTRUCTION OF SYSTEM.—The Macao Electric Lighting Co. has recently placed an order for new material and machinery with the General Electric Co. of China, Ltd. For the accommodation of the new generating units, a new power station is already being constructed by Dorman Long & Co., Ltd. Among the new equipment is a large quantity of British h.p. cables to replace all the overhead lines which have been serving Macao since the company commenced operations some twenty years ago.

Manchester.—PRICE OF ENERGY REDUCED.—The Highways Committee has made arrangements with the Altrincham Electric Supply, Ltd., for a reduction of the present cost of electrical energy in the company's area within the Manchester boundary in consideration of increased consumption.

Mirfield.—REORGANISATION OF ELECTRICITY DEPARTMENT.—The Urban District Council has received sanction to a scheme of reorganisation of the Electricity Department, including the borrowing of £27,000 for laying underground cabling and for current expenditure. The loan is part of an estimated expenditure of £40,000 intended to put the undertaking on a sound technical and business basis. It is intended to build a showroom at Fold Head.

Portland.—ELECTRICITY COMMISSION INQUIRY.—The Electricity Committee has received a letter from the Electricity Commission asking to be informed whether the Council had adopted either (*a*) a scheme for assisted wiring or (*b*) a scheme for the hire and/or hire-purchase of electrical apparatus; or an all-in or two-part tariff for domestic supplies subsequent to July, 1930, and if not, the reasons or circumstances which had influenced the Council in not making them available. The Committee decided to inform the Commissioners of the present position and instructed the engineer to report with regard to a scheme for assisted wiring by means of two-part meters.

Shipston-on-Stour.—OVERHEAD LINE.—The Rural District Council has decided to raise no objection to the erection of an overhead line from Ebrington to Shipston by the Shropshire, Worcestershire & Staffs Electric Power Co.

South Africa.—INCREASED CONSUMPTION AT JOHANNESBURG.—During the year ended June 30th the sales of electricity by the Johannesburg municipal department totalled 111,045,655 kWh, compared with 103,392,597 kWh in the preceding year.

Southend.—YEAR'S WORKING.—There was an increase of over 20 per cent. in the amount of energy sold during the year ended March 31st last by the Corporation Electricity Department (borough electrical engineer: Mr. A. C. Johnson); the total was 24,919,638 kWh. The revenue account shows an income of £240,242 and a gross profit of £122,278. The charges against this included £49,472 for special redemption of loan debt and £7,300 put to the relief of the general rate. The balance of £59,959 is allocated as follows: appropriated for relief of rates, 1933-34, £7,500; working balance, £40,000; special reserve against effect of recent price reductions, £10,000; unappropriated £2,459.

SUPPLY TO NURSERIES.—The Town Council has decided, subject to the consent of the Rochford Rural Council, to apply to the Electricity Commissioners for an Order to supply electricity to the Grosvenor Nurseries at Wakering.

Stoke-on-Trent.—SUPPLY TO ELECTRIC KILN.—The electrical engineer has received an inquiry for a supply to a new kiln now being erected by Messrs. Copeland & Sons, Ltd., and it has been decided that a supply should be given on the tariff approved for electric kilns, subject to the company agreeing to pay half the cost of the new main required.

Taunton.—OVERHEAD LINES.—The Town Council has received sanction to a loan of £10,000 for the erection of overhead lines.

Wakefield.—TARIFF REDUCTION.—The Electricity Committee has reduced the lighting rate by ¼d. per kWh and the heating rate from 1d. to ¾d.

Wallasey.—The Electricity Committee has approved a proposal that, with the object of meeting the requirements of the promenade extensions, including the swimming pool and the lighting of the carriageways, a cable be laid from the Tower sub-station to the new sub-station to be provided in the baths buildings, the total estimated cost of the work, including the transformer and switchgear being £490.

Wellingborough.—L.P. LINE.—The Urban District Council has declined to approve a proposal by the Wellingborough Electric Supply Co. to erect an overhead line on the Brook Farm Estate, off Finedon Road, Wellingborough.

West Midlands.—THE J.E.A.'S ACCOUNTS.—The accounts of the West Midlands Joint Electricity Authority for the year ended March 31st last show a credit balance on bulk supply revenue account of £6,395, the total income being £417,331. On the distribution area revenue account, however, there was a total deficiency of £10,904. The administrative expenses account showed a deficit of £97, the total expenses being £2,363. The report states that the maximum load (half-hourly) on the system was 80,620 kW, against 78,840 kW in the preceding year. This winter a demand of 84,000 kW is anticipated. The output rose from 209.2 to 228.5 million kWh, divided as follows: Wolverhampton Corporation 102.3 million, Midland Electric Corporation for Power Distribution, Ltd., 77.2 million, Walsall Corporation 25.8 million, West Bromwich Corporation 23.2 million. The average price paid for bulk supplies fell from 0.468d. to 0.436d. per kWh. The p.f. plant at the Birchills, Walsall, station is operating satisfactorily. A new battery is being installed at Wolverhampton. There was a fire due to failure in the h.p. switchgear at Ocker Hill station in July, but owing to the interconnecting arrangements there was no serious interruption of supply. It has been decided to dispose of the West Bromwich plant, but an additional 12,000-kW bank of transformers is being installed to meet the Corporation's load. Ironbridge station was completed during the year and officially opened in October, 1932. (The station was described in our issue of September 2nd, 1932). The J.E.A. is operating Ironbridge for its own district pending the fixing by the Central Board of the date of commencing the operation of the Central England scheme. The first few weeks' results have shown that satisfactory operating costs will undoubtedly be achieved. Good progress has been made with the Shropshire distribution scheme but development has been retarded by the trade and agricultural depression. A sub-committee is investigating the possibility of submitting a suitable scheme for rural development with the aid of financial assistance from the Development Commission. Mr. E. F. Hetherington is chief engineer and manager to the Authority.

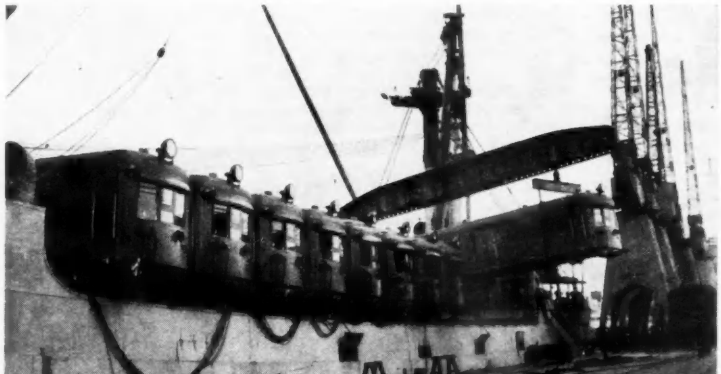
Wigan.—EXTENSION WANTED.—The Rural District Council has been informed by the Corporation Electricity Committee that the demand for electricity in the Church Lane and Wigan Road area at Shevington would not justify an extension of mains at the present time. The Council has decided again to request the Corporation to make the extension, and failing a satisfactory reply is to refer the matter to the Electricity Commissioners.

Ystradgynlais.—JOINT WORKING WITH PONTARDAWE.—Ystradgynlais and Pontardawe Rural District Councils have reached an agreement for the joint working of an electricity scheme in the Ystradgynlais district.

Traction

Austria.—RAILWAY ELECTRIFICATION.—According to the Vienna *Reichspost*, the Austrian Federal Government intends to use a portion of the money raised by the Austrian Internal Premium Loan for the electrification of the railway between Salzburg and Linz.

Belgium.—RAILWAY ELECTRIFICATION.—In the September-October *Bulletin* of the Société Belge des Electriciens, M. J. le Jeune, of the Compagnie Générale d'Entreprises Electriques et Industrielles, gives some interesting details of the result of the first year's working of the electrified suburban railway between Brussels and Tervueren. While running as a steam railway, the line lost the bulk of its traffic owing to the extension of the tramway system. Now, as an electric line, it is not only regaining its old patronage, but by the frequent and rapid service, coupled with low fares, it is steadily creating a new clientèle. In the old days of steam traction the journey, including six stops, occupied twenty-eight minutes, the average speed being under 20 m.p.h. Now the electric trains, with nine stops, complete the journey in twenty-two minutes at an average of 24½ m.p.h.



Electric coaches from the Gloucester Wagon Works being loaded on to the s.s. *Balmoria* for shipment to India

Starting with twenty-four trains per day, the traffic has grown to such an extent that fifty-eight trains are run on weekdays and fifty-six on Sundays. Similarly, the number of passengers has shown a rapid growth, from about 350 per day for the old steam trains to 1,100 to 2,600 on weekdays, while on one of the holidays during the past summer as many as 9,975 people were carried.

Dover.—TROLLEY-BUS PROPOSAL.—At a special meeting of the Town Council on Tuesday, a resolution was passed by fourteen votes to six to promote a Bill in Parliament to give the Council power to introduce trolley-buses in place of the existing trams. The estimated cost is £85,000.

Northern Ireland.—BELFAST.—The Tramway Committee has appointed a sub-committee to investigate the case of Oldpark residents who have requested the extension of the tram lines half a mile farther out for their convenience.

Nottingham.—PROVISIONAL ORDER.—The Corporation has applied to the Minister of Transport for a Provisional Order authorising it to run trolley buses along certain routes in the town.

West Riding.—PROVISIONAL ORDER.—The Mexborough and Swinton Traction Co. has applied to the Minister of Transport for a Provisional Order authorising it to operate trolley buses along certain routes in the urban districts of Swinton and Wath-upon-Dearne, Mexborough and Rawmarsh.

Communications

Australia.—BASS STRAITS TELEPHONE CABLE.—Among the provisions of the Australian Budget is £180,000 for the laying of a submarine cable across the Bass Straits to provide telephone communication between Tasmania and the mainland.

EXCHANGE DEVELOPMENT.—In the Post Office estimates for the coming year £594,460 is appropriated for new telephone exchange services. It is thought that a large part of this is to provide two automatic telephone exchanges to replace the central manual exchange in Melbourne. A sum of £131,000 is also appropriated for trunk lines and £95,450 for new broadcasting stations.

BEAM AND CABLE SERVICES.—It is believed that legislation has been prepared to enable the Government to take over the operation of the Australian end of the beam and cable services, but that the Government is still hesitating. As it is the dominating partner in Amalgamated Wireless (Australasia), Ltd., which operates the beam service, it is not considered that there would be much difficulty in arranging this change, but for the cables an agreement with the interests concerned would be necessary.

Dutch East Indies.—NEW RADIO STATIONS.—The principal transmitter for the new broadcasting station at Priok has been shipped from Holland. The station is to be known as "Nirom," and is expected to commence operating next March. Smaller local transmitters are to be built at Surabaya, Samarang, Bandoeng, and elsewhere, while "distribution centres" are to be established in villages.

Egypt.—NEW WIRELESS STATIONS.—Three wireless stations are to be erected in the frontier districts of the Egyptian section of the Libyan desert. Owing to high winds and sandstorms, telegraph communication with these areas has often broken down in the past. It is understood that the stations will be built in the Kharga Oasis, the Fararafra Oasis, and in the neighbourhood of Tor, an island of the Sinai Peninsula. The credits necessary for their erection will be included in next year's Budget.—*Reuter* (Alexandria).

France.—RADIO TAXATION.—The Municipal Council of Saint Jean du Gard has resolved to establish a municipal tax on broadcast receivers. Listeners' legal advisers contend that although municipalities have wide local taxation powers, they are specific and do not therefore apply to radio sets.

Germany.—RADIO LICENCE STATISTICS.—On November 1st the number of listeners totalled 4,635,537, compared with 4,524,643 on October 1st, 1933, says *World-Radio*. The number of free licences issued to unemployed persons has further decreased by 12,273 since October, and now totals 503,420. The number of listeners in Bavaria, which is included in the grand total mentioned above, increased by 8,464 to 364,061 during the month of October.

RADIO ROYALTIES REDUCED.—In an endeavour to encourage the export of radio receiving equipment, the Telefunken Co. has reduced the royalty fees payable to it by set manufacturers to a minimum of one mark per set, which will enable manufacturers to reduce production costs.

Great Britain.—RADIO RELAY SERVICES.—The Wakefield Corporation Highways Committee has interviewed representatives of Wireless Relay Services, Ltd., with regard to difficulties of operation.

Broadcast Listeners' Service, Ltd., is to change the name of its company operating at Wellingborough to the Wellingborough Broadcast Relay Service, Ltd.

Hongkong.—TELEPHONY.—In the *Far Eastern Review*, Mr. J. P. Sherry, manager of the Hongkong Telephone Co., Ltd., gives details of the progress of the undertaking. Prior to 1925 the telephone system in Hongkong was operated through the Oriental Telephone & Electric Co., from London. In 1925, however, the Colonial Government gave a franchise to the Hongkong Telephone Co. on condition that within a fixed period it would convert the entire system to the most modern type, and that all overhead distribution within city limits be replaced by underground cables. The last-mentioned work was tackled in so determined a fashion that by 1928 approximately 80 per cent. of the circuits were served by direct underground connections. In 1930 the whole system was changed over to direct automatic working without any addition to the normal staff. From 1925 onwards the company experienced rapid progress, the present number of telephones operating in Hongkong being close upon 16,000. In 1931 teleprinters were introduced into the Colony, and in the same year the company established trunk telephone communication between Hongkong and Canton. Coincident with the introduction of the trunk cable picture transmission was introduced for demonstration purposes. Rural automatic exchange operation is satisfactory in what is known as the New Territories, and has supplied a greatly needed want.

India.—MORE TELEPHONE LINKS.—A section of the telephone line which is to link Nagpur and Jubbulpur and the latter with Calcutta, Simla, Bombay, and other Indian towns, has been opened between Jubbulpur and Gondia. The section between Gondia and Nagpur is practically completed.

Isle of Man—NEW TELEPHONE EXCHANGE.—A new telephone exchange was inaugurated at Douglas last week-end.

Kettering.—AUTOMATIC TELEPHONY.—The Urban District Council is to urge upon the Postmaster-General the desirability of introducing automatic telephony in the district.

South Africa.—UNION-RHODESIA TELEPHONE OPENED.—The telephone service between the Union and Southern and Northern Rhodesia is now open. The line runs *via* Pietersburg, Messina, Bulawayo, and Salisbury. From Pretoria to Bulawayo the distance is 601 miles, to Salisbury 900 miles, to Livingstone 888 miles, and to Lusaka and Broken Hill 1,268 miles. To Bulawayo the day rate is 8s. for three minutes, and after 7 p.m. 5s. 6d.; and to Livingstone and Salisbury, 11s. and 8s. Other trunk extensions are nearing completion, especially between Johannesburg and Capetown, and it is hoped soon to have an almost instantaneous trunk service.

PROPOSED PAN-AFRICAN COMMUNICATIONS UNION.—It is proposed to hold a meeting in South Africa to consider the practicability of forming a Pan-African communications union. The Governments of Southern and Northern Rhodesia, Tanganyika, Kenya and Uganda, the Belgian Congo and Portuguese East Africa will be invited to send representatives.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Aldershot.—December 5th. Electricity Department. E.h.p. switchgear and e.h.p. oil-cooled transformers. (See this issue.)

Arbroath.—November 30th. Town Council. Various works, including electrical, at housing scheme. Specifications, &c., from burgh engineer (deposit £1); offers to Town Clerk, Town House, Arbroath.

Argentina.—BUENOS AIRES.—December 4th. State Oilfields. Portable arc-welding equipment and grinding machine. (A.Y. 12076.)* Rotary air compressor. (G.Y. 13146.)*

November 27th. 600-V cable and house-wiring material. (A.Y. 12059.)*

Australia.—MELBOURNE.—Post and Telegraph Department. November 28th. Switchboard cables. (A.Y. 12002.)*

December 5th. Microphones. (A.Y. 12030.)* Telephone switchboard cable. (A.Y. 12015.)*

December 12th. Telephone parts and accessories. (A.Y. 12032.)* Telephone indicators. (A.Y. 12033.)* Multiple twin telephone cables. (A.Y. 12016.)*

December 19th. Telephone dial parts. (A.Y. 12031.)* Vitreous resistances. (A.Y. 12042.)*

January 2nd. Telephone switchboard lamps and sockets. (A.Y. 12053.)* Telephone jacks and number plates. (A.Y. 12066.)*

January 9th. Hand-operated telephone generators. (A.Y. 12064.)* Bells and buzzers. (A.Y. 12065.)*

State Electricity Commission of Victoria. December 4th. 22,000-V switchgear and accessories comprising oil circuit-breaker equipments with current transformers. (A.Y. 12014.)*

January 8th. Five automatic induction voltage regulators. (A.Y. 12071.)* 115-kW a.c. motor. (A.Y. 12053.)*

January 15th. Triple braided copper conductor (A.Y. 12054.)*

January 16th. Telephone timing clocks. (A.Y. 12085.)* Telephone switchboard keys and accessories. (A.Y. 12081.)* Resistances and reactances. (A.Y. 12083.)*

BRISBANE.—January 31st. City Electric Light Co., Ltd. Land and submarine cable. (A.Y. 12072.)*

Edinburgh.—December 1st. Corporation. Installation of two electrically operated goods lifts at the electricity supply station, Dewar Place. Specifications from city architect, City Chambers. Tenders to Town Clerk.

Egypt.—CAIRO.—Ministry of the Interior. November 30th. Six 50-kVA transformers. (A.Y. 12013.)*

Erith.—December 7th. Electricity Department. Three 500-kVA transformers. (See this issue.)

Fife.—November 25th. County Council. Various works, including electric lighting, at Cardenden housing scheme (thirty houses). Schedules from W. Williamson & Hubbard, chartered architects, Kirkcaldy. Tenders to Mr. J. M. Mitchell, county clerk, County Buildings, Cupar.

Hastings.—December 2nd. Electricity Department. Supply of transformers for the year 1934. (November 10th.)

December 6th. Poles, ironwork, &c., for overhead lines. (See this issue.)

India.—NEW DELHI.—December 4th. Indian Stores Department. 200/230-V, single-phase, 50-cycle ceiling fans. (A.Y. 11959.)*

December 11th. D.c. ceiling fans. (A.Y. 11965.)*

January 8th. A.c. and d.c. table fans. (A.Y. 11967.)*

London.—ST. PANCRAS.—December 7th. Borough Council. Vehicle-actuated traffic signals. (November 17th.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department.—December 5th. 2,400 lb. of cored solder. (G.Y. 13046.)*

January 8th. Microtelephone cradles. (A.Y. 12046.)* Telephone jacks. (A.Y. 12045.)*

January 9th. A 100-Ah secondary battery with 60 cells. (A.Y. 12047.)*

January 16th. Thirty-five miles of v.i.r. wire. (A.Y. 12086.)*

January 16th. Public Works Department. Four 1,500-kVA transformers. (A.Y. 12017.)*

Northern Ireland.—BELFAST.—November 28th. Tramways Committee. Motor-generator testing equipment for tramcar circuit-breakers. Town Clerk.

Persia.—TEHERAN.—January 7th. Municipal Council. Boilers, turbo-alternator sets, switchboards, transformers and cables, in connection with a proposed power station. (A.Y. 12079.)*

Rhyl.—November 28th. Urban District Council. Cable for twelve months. (November 17th.)

South Africa.—KROONSTAD.—December 4th. Municipal Council. Machinery and plant for a power station. (A.Y. 12004.)* Steam raising plant. (G.Y. 13038.)* Motors, meters, cable, transformers, conductors, kiosks and other electrical items. (A.Y. 12029.)*

CAPETOWN.—November 29th. Electricity Department. Fifty automatic street-lighting controllers. (A.Y. 11994.)* 7,000 iron-clad service cut-outs. (A.Y. 12051.)*

November 30th. H.p. and l.p. telephone cables. (A.Y. 12052.)*

JOHANNESBURG.—December 21st. City Council. Twelve air compressors and spares, three oil separators, three air receivers and single-phase motors, &c. (G.Y. 13152.)*

Swansea.—December 4th. Corporation. Steam and feed water piping, valves, &c., for Tir John power station. (November 3rd.)

December 20th. Electricity Department. Boiler feed pumps, &c. (See this issue.)

Uruguay.—MONTEVIDEO.—November 30th. State Electricity Supply and Telephones Administration. 101,400 metres of lead-covered conductors. (A.Y. 12012.)

Warmley.—November 24th. Rural District Council. Materials and labour in connection with an extension of the Council's electricity mains. (November 10th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Cheltenham.—Town Council. Accepted. Wiring houses on the Whaddon Lane Estate (£560).—F. H. Bastin & Sons.

Glasgow.—Corporation Lighting Committee. Accepted. Cable.—Croydon Cable Works, Ltd. Street lanterns.—Engineering and Lighting Equipment Co., Ltd.

Corporation Housing Committee. Accepted. Electrical installation at Broomloan Road housing scheme (£1,961).—R. J. McIntyre.

Electricity Committee. Accepted. Plant required in connection with the change of frequency under the Central (Scotland) Electricity Scheme. Fifteen new crane motors and two new rotors (£599).—General Electric Co., Ltd.

Government Contracts.—The following contracts were placed by the various Government departments during October:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Motor alternators.—Electric Construction Co.

Boiler plant, calorifiers and kitchen equipment.—Sturtevant Engineering Co.

Electric cable (p.i.).—Connollys; Hackbridge Cable Co.

Electric cable (v.i.r.).—Anchor Cable Co.; B.I. Cables; Craigpark Electric Cable Co.; Derby Cables; Edison Swan Cables; Enfield Cable Works; G.E.C.; W. T. Glover & Co.; Hackbridge Cable Co.; Henley's; Hooper's Telegraph & I.R. Works; I.R.G.P.; Johnson & Phillips; Macintosh Cable Co.; Mersey Cable Works; St. Helens Cable Co.; Siemens Electric Lamps & Supplies.

Conduit Accessories.—Electrical Conduits; Simplex Electric Co.; Eureka Conduits & Fittings Co.; Barton & Sons; Walsall Conduits; G.E.C.

Contactors (voltage control).—Everett Edgecumbe & Co.

Control gear.—Electrical Apparatus Co.; Laurence, Scott & Electromotors; Met.-Vick. Electrical Co.

Motor generators and boosters.—W. Mackie & Co.; Mawdsleys.

Motor generator set.—B.T.-H. Co.

Automatic domestic refrigerators.—International Refrigerator Co.

Starters, resistances, &c.—E. N. Bray; Watford Electric & Mfg. Co.

Switches.—W. McGeoch & Co.; Veritys; L. Weekes (Luton).

Switchboards.—Ferguson, Pailin.

W/t transmitters.—Gambrell Bros.; Marconi's; R.I., Ltd.; H. W. Sullivan.

Three-ton overhead electric travellers.—Joseph Adamson & Co.

Wireless valves.—G.E.C.; Mullard Radio Valve Co.; Ediswan.

WAR OFFICE.

Portable secondary batteries.—Pritchett & Gold and E.P.S. Co.

Electric lighting fittings.—G.E.C.; Revo Electric Co.

Electric brass smelting furnace.—Electric Furnace Co.

Electric annealing furnace.—Birmingham Electric Furnaces.

Rotary convertor.—Crompton Parkinson.

AIR MINISTRY.

Dry batteries.—Britannia Batteries.

Batteries.—C.A.V. Bosch.

Direction-finding equipment (for Singapore).—Marconi's.

Motor alternators.—W. Mackie & Co.

W/t receivers.—Marconi's.

POST OFFICE.

Telephonic apparatus.—Automatic Electric Co.; G.E.C.; Phœnix Telephone & Electric Works; Plessey Co.; Siemens Bros.; Standard Telephones; Telephone Mfg. Co.

Testing and protective apparatus.—Standard Telephones.

Battery stores.—Siemens Bros.

Cable.—Connollys; G.E.C.; Hackbridge Cable Co.; Henley's; Siemens Bros.; Standard Telephones; United Telephone Cables.

Loading coils.—Standard Telephones.

Telephone cords.—Phœnix Telephone & Elec. Works.

Rectifiers.—Ediswan.

Batteries (Swansea telephone exchange).—Pritchett & Gold & E.P.S. Co.

Electric lighting.—Liverpool (Hatton Garden) new parcel office.—Harland & Wolff.

Motor generator, l.p. switchgear and l.p. cables (Post Office Savings Bank, W.).—Bruce Peebles & Co.

Telephone exchange equipment.—Shrewsbury; Birmingham trunk exchange.—Automatic Electric Co. Hanley; Elgin; Mint (London); Exeter; Pinhoe (Exeter): G.E.C. London trunk exchange: Standard Telephones.

Exchange fitting by contractors.—South Lancs district: Automatic Electric Co. North Midland district: Ericsson Telephones. South Midland and Eastern district: G.E.C. South Western district: Siemens Bros. London, S.E.: Standard Telephones.

Telephonic repeater equipment (Glasgow).—Standard Telephones.

Voice-frequency telegraph equipment.—Milford Haven; Cardiff trunk exchange: Standard Telephones.

CROWN AGENTS FOR THE COLONIES.

Centrifugal pumps and transmission gear.—Harland Engineering Co.

Electric motor and starters.—Met.-Vick. Elec. Export Co.

Electric lighting installation.—G.E.C.

Oil engine driven generator.—Belliss & Morcom.

Switchboard and accessories.—B.T.-H. Co.

Wireless transmitting apparatus.—Marconi's.

Kettering.—U.D.C. Electricity Department. Accepted. Metering equipment for supply to Corby (£297).—Ferranti, Ltd.

Manchester.—Electricity Committee. Accepted. Cable laying.—Callender's Cable & Construction Co., Ltd.

Middlesex.—County Health Committee. Accepted. Three electric cookers, three hot cupboards and four water-boilers at Clare Hall Sanatorium (£173).—Jackson Electric Stove Co., Ltd. Installation and wiring (£85).—T. Clarke & Co., Ltd.

Newcastle-on-Tyne.—City Council. Accepted. Changing-over of electric motors and other apparatus at the Barrasford Sanatorium (£126).—Falconar Cross & Co., Ltd.

Stoke-on-Trent.—Housing Committee. Accepted. Wiring and fittings for thirty-seven houses on the Goms Mill estate.—E. Holloway.

Thurlstone.—Education Committee. Accepted. Installation of electric lighting at Townhead schools.—J. Windle.

Wallasey.—Electricity Committee. Recommended. Turbine blading renewals (£1,059).—English Electric Co., Ltd.

Wick.—Town Council. Accepted. Electric lighting installation in 146 houses.—R. Finlayson & Co.

Forthcoming Events

Association of Mining Electrical Engineers.—Saturday, November 25th. Visit to the Cardiff Engineering Exhibition. (*Kent Sub-Branch*).—Saturday, December 2nd. Dover Technical Institute. 6.30 p.m. "Developments in Modern Illuminating Engineering." Mr. J. M. Barnicot.

Electrical Power Engineers' Association.—(*Manchester Section*) —Saturday, November 25th. Grand Hotel, Manchester. 5.30 for 6 p.m. Annual dinner and dance.

Institution of Electrical Engineers.—Monday, November 27th. 7 p.m. Informal meeting. Discussion on "Hot-cathode Lamps." Opened by Mr. J. W. Ryde. (*South Midland Centre*).—Friday, November 24th. Grand Hotel, Birmingham. 6.30 for 7 p.m. Annual dinner. (*West Wales (Swansea) Sub-Centre*).—Friday, November 24th. Electric House, Swansea. 6 p.m. "Notes on the Jointing of E.h.p. Underground Cables." Mr. G. O. James. (*North-Eastern Students' Section*).—Friday, November 24th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Precision Alternating Current Measurements." Mr. M. Waters. (*London Students' Section*).—Saturday, November 25th. 2.20 p.m. Visit to the London Electric Railway sub-station, Wood Green. Tuesday, November 28th. Institution, London. 6.15 p.m. "Methods and Associated Apparatus for the Accurate Determination of Radio Frequencies." Mr. F. J. Tompsett. (*North-Eastern Centre*).—Monday, November 27th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Application of Automatic Voltage and Switch Control to Electrical Distribution Systems." Messrs. W. Kidd and J. L. Carr. (*Scottish Centre*).—Tuesday, November 28th. Grosvenor Restaurant, Glasgow. 6.30 for 7 p.m. Annual dinner. (*North Midland Students' Section*).—Tuesday, November 28th. Hotel Metropole, Leeds. 7.15 p.m. "The Economic Application of Electricity to Space Heating." Mr. T. Illingworth. (*Mersey and North Wales (Liverpool) Centre*).—Wednesday, November 29th. Adelphi Hotel, Liverpool. Annual dinner. (*Meter and Instrument Section*).—Friday, December 1st. Institution, London. 7 p.m. "Current Transformer Testing" and "Leakage Phenomena in Ring-Type Current Transformers." Mr. A. H. M. Arnold. (*North-Western Students' Section*).—Tuesday, November 28th. Engineers' Club, Manchester. 7.15 p.m. "Engineering Problems of the Grid." Mr. R. D. Kapp.

Edinburgh Electrical Society.—Wednesday, November 29th. Philosophical Institution, Edinburgh. 8 p.m. "Mercury Arc Rectifiers." Mr. G. Henderson.

Physical Society.—Friday, December 1st. Imperial College of Science and Technology, South Kensington. 5 p.m. Short papers.

Notes

A Flexible Overhead-line Conductor

There has recently been erected for the Spalding U.D.C. a 0.1 sq. in. flexible segmental conductor which is circular and not stranded. The work has been carried out under the supervision of Mr. F. R. C. Roberts, the Council's engineer and manager. The inventor of the conductor, Mr. A. Avis, is managing director of the Segmented Wire Corporation, which is responsible for the work. It is claimed that the use of this conductor effects a reduction of 25 per cent. in the cost of an overhead line, apart from its easing of wayleave difficulties due to the possibility of using longer spans. The same type of conductor is also being supplied to Spalding in underground cable, made by the Metropolitan Cable & Construction Co., Ltd., under licence from the Segmented Wire Corporation; we believe this is the first occasion on which this type of conductor has been so employed.

The E.A.W. Diploma

The Training and Diploma Committee of the Electrical Association for Women has fixed the following procedure for future awards:—Candidates wishing to obtain the E.A.W. Certificate will be required to show that they hold a recognised certificate in domestic subjects, the minimum being an Institutional Housekeeper's Certificate obtainable after one year's full-time course at a recognised college or polytechnic. The E.A.W. certificate examination on the electrical side will be held once or twice a year at different centres throughout the country; certain examinations will be accepted as exempting candidates from sitting for this examination. When at least two years' experience has been obtained, the certificate holder may apply for the Diploma on a special form supplied by E.A.W. headquarters; if the application is accepted by the Committee, the candidate will be required to pass a practical test as to her ability in demonstration and/or salesmanship.

Trials of the "Lectro"

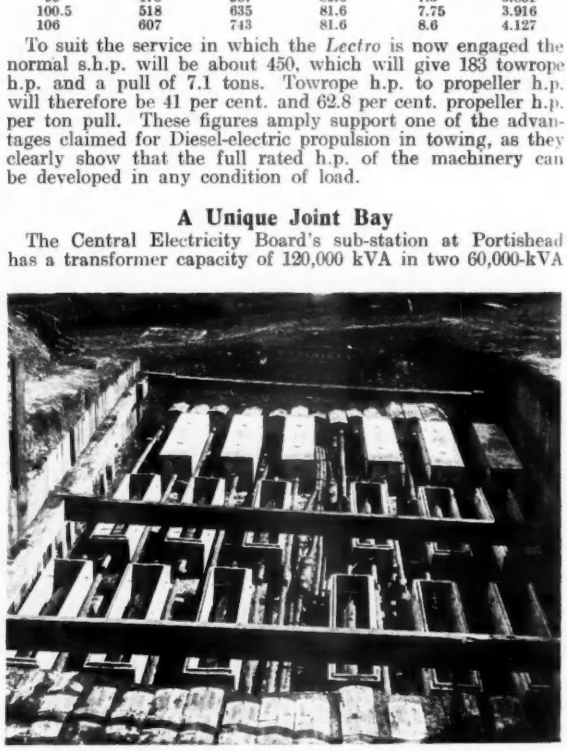
Trials have been carried out on the Diesel-electric tug *Lectro* at Long Reach, when six standard type Thames swim barges were towed in the usual formation, *i.e.*, in three rows of two abreast close up to stern of the tug and lashed together. The load was 1,261 tons of coal, the total displacement of the tow being 1,741 tons. Towrope pull was recorded by means of a 10-ton dynamometer attached to the towhook of the tug to which the barges were coupled. Runs with and against the tide on a measured mile gave a mean speed through the water at recorded s.h.p. and towrope pull, and hence a speed-pull from which the following results were obtained:—

Propeller r.p.m.	S.h.p.	Engine b.h.p.	Transmission eff. %.	Tons pull.	Speed knots.
63	130	163	79.8	3.15	2.49
80	252	307	82.0	5.0	3.146
91	366	443	82.6	6.2	3.502
99	478	587	81.6	7.3	3.801
100.5	518	635	81.6	7.75	3.916
106	607	743	81.6	8.6	4.127

To suit the service in which the *Lectro* is now engaged the normal s.h.p. will be about 450, which will give 183 towrope h.p. and a pull of 7.1 tons. Towrope h.p. to propeller h.p. will therefore be 41 per cent. and 62.8 per cent. propeller h.p. per ton pull. These figures amply support one of the advantages claimed for Diesel-electric propulsion in towing, as they clearly show that the full rated h.p. of the machinery can be developed in any condition of load.

A Unique Joint Bay

The Central Electricity Board's sub-station at Portishead has a transformer capacity of 120,000 kVA in two 60,000-kVA



A battery of large cable joints at a grid sub-station

units. The accompanying picture shows the bay which contains the joints in the cables connecting the sub-station to the Portishead generating station of the Bristol Corporation. There are eighteen 0.5 sq. in. 33,000-V impregnated paper-insulated, lead-covered and served cables, and the approximate route lengths are 286 and 368 yards. These cables constitute two three-phase circuits; therefore, there are three cables, or 1.5 sq. in. of copper per phase.

In the back row are six concrete boxes with the covers on, and the joints in the concrete boxes, with box covers removed, are seen in the two rows in the foreground. The tiles in the foreground are the normal protection for the cables. In addition to the cables already mentioned, this bay contains five joints in the five multicore cables connecting the power station to the grid sub-station. The dimensions of the excavation for the joint bay were 22 ft. long by 17 ft. 6 in. wide, and 6 ft. 3 in. deep. The jointing formed part of Henley's contract for the South-West England portion of the grid.

Appointments Vacant

Lady demonstrator for Willesden Electricity Department.

Junior charge engineer for Portsmouth Electricity Department.

Electrical engineer and manager for the Ealing Corporation electricity undertaking.

(See our classified advertisements.)

Makers' Names Wanted

STELLA-VITA ultra-violet-ray lamp.

ELITE vacuum cleaner.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

A North London newspaper, in referring to the coming severance by **Sir William Ray** of his lengthy association with Central Hackney (L.C.C. representation) and naming the suggested new candidate, remarks that the whole future of Sir William " will be bound up with his Parliamentary duties and the control of the *electricity publicity and push company* of which he is now the head."

Mr. F. W. Maynard was presented with a grandfather clock for the best paper submitted during the year at a meeting of the Warwickshire and South Staffordshire branch of the Association of Mining Electrical Engineers on November 16th. The presentation was made by the Earl of Dudley.

Mr. T. J. Tyler, A.M.I.E.E., was married on November 4th at St. James's Church, Spanish Place, London, to Miss Dorothy B. Shipley.

Mr. W. M. L'Estrange was, on October 10th, elected chairman of directors of the City Electric Light Co., Ltd., Brisbane, for the remainder of the company's year, in consequence of the death of **Mr. E. J. Holmes,** which occurred on September 28th. Mr. James Harvy Holmes was appointed director to hold office during the period for which the late Mr. E. J. Holmes would have held office.

The Marchese Marconi has had the Grand Cordon of the Order of the Rising Sun conferred upon him by the Emperor of Japan, on the occasion of his visit to that country. A message from Tokio states that this Order is usually reserved for representatives of Royal families or the highest ranks of the diplomatic corps in Japan.

Mr. P. B. Hall, M.I.E.E., has resigned his position as assistant managing director of Messrs. Erskine, Heap & Co., Ltd., and has been appointed sole agent to Messrs. Elliott Bros. (London), Ltd., for the counties of Yorkshire (except Cleveland), Lancashire, Cheshire, Derbyshire, Nottingham, Lincoln, Flint, Merioneth, Denbigh, and Carnarvonshire. All inquiries should in future be addressed to Mr. Hall's office at Hardy's Buildings, Cateaton Street, Manchester, 3. Messrs. Elliott Bros. announce that their Midlands and Wales district agents, Messrs. Erskine, Heap & Co., Ltd., ceased to represent them as from November 15th. This arrangement has been effected by mutual agreement.

Elliott & Fry

Mr. P. B. Hall

Mr. P. Lister, managing director of Messrs. R. A. Lister & Co., Ltd., is to make a voyage round the world to develop business for his company in a number of important markets. In making the announcement at the annual meeting of the company on Friday last, Mr. A. A. Lister, the chairman, said that he believed the results which would accrue would enable them to look forward with confidence to the financial year upon which they had just embarked.

Sir Felix J. C. Pole and **General Wade Hampton Hayes** have joined the board of the Utilities Corporation (Poland), Ltd. Sir Felix Pole is well known to our readers as chairman of Associated Electrical Industries, Ltd., and of the Metropolitan-Vickers Electrical Co., Ltd., while General Hayes is deputy-chairman of the Greater London and Counties Trust, Ltd., and is also on the boards of Edmundson's Electricity Corporation, Ltd., and the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Mr. J. Ratcliffe has been appointed resident engineer to the electricity undertaking of the Whitworth Urban District Council. Mr. Ratcliffe was formerly resident engineer and manager of the Dunoon & District Electricity Supply Co., Ltd., being appointed to that position a few months before the inauguration of Dunoon electricity undertaking in September, 1930. Before going to Dunoon he had held positions with the British Electrical Federation, the Birkdale District Electricity Supply Co., Ltd., and the Bolton Corporation Electricity Department. In the course of his earlier days he was connected with the Edison companies operating in Italy. Mr. Ratcliffe is an Associate of the Institution of Electrical Engineers and a member of the Overhead Lines Association.

Mr. J. Ratcliffe

Mr. L. L. Horrell, electrical engineer to the Pretoria Municipality, and **Mr. M. G. Nicolson,** the town clerk, are expected in this country shortly in connection with the proposed extensions to the municipal power station mentioned in our last issue. They have been deputed by the City Council to consult with Messrs. Merz and McLellan, London (consulting engineers to the Council), before tenders are invited. These are to be invited simultaneously in this country and in South Africa, and the two representatives will cable their recommendations with regard to acceptance of tenders to the Council, as the work will take fifteen months and the new plant is required by January, 1935. Mr. Nicolson is also to investigate transport methods. The Pretoria City Council proposes to abandon the tramway system, and either electric trolley buses or omnibuses will be substituted. No definite alternative system has yet been decided upon, but it is considered that trolley buses are favoured.

Mr. J. S. Edstrom, managing director of the A.S.E.A. (Allmänna Svenska Elektriska, A.B.), after having occupied this position for thirty years, is to resign, and will be succeeded at the end of this year by **Mr. Arthur Linden,** hitherto deputy managing director. Mr. Edstrom is remaining on the board.

Mr. F. P. Culbert has been appointed European manager for the Radio Corporation of America, to succeed **Mr. A. H. Morton.** Mr. Morton has been transferred to New York, where he has assumed his new duties with the National Broadcasting Company, a wholly owned subsidiary of the R.C.A. The European headquarters of the R.C.A., formerly situated in Paris, have been transferred to the new headquarters at 142-150, Wardour Street, W. Mr. Culbert has assumed his new duties as European manager of the R.C.A. in addition to his present duties as managing director of R.C.A. Photophone, Ltd., and European manager of the R.C.A. Victor Co., Inc.

Mr. C. W. Reeve, managing director of the Associated Equipment Co., Ltd., has been elected chairman of the board. He will continue to act as managing director. **Lt.-Col. J. T. C. Moore-Brabazon** has been elected deputy chairman.

Electricity in Rural Wales

IN an article contributed to the Welsh Housing and Development Year Book, Messrs. A. W. Ashby and W. H. Jones, of the Department of Agricultural Economics, University College, Aberystwyth, give data regarding the use of electricity on fifty-seven farms in Wales. On twelve of these it was used for power, heat and light, on eighteen for heating and lighting, and on twenty-seven for lighting only. Energy for lighting the house and the farm is generally measured on one meter. The consumption per lamp does not fall off greatly with an increase in the number installed. The cost of lighting on forty-seven farms is shown in the following table:—

Size of house.	No. of farms.	Average number of lights.		kWh per farm.	Cost per farm.
		House.	Farm.		£ s. d.
2–6 rooms ...	29	4	3	129	3 18 9
7–10 rooms ...	10	10	5	261	7 18 8
Over 10 rooms ...	8	14	7	317	9 12 10

The cost of wiring for the three sets of conditions was 15s. 6d., 14s. 7d., and 11d. 9d. per lamp. Almost all the farmers regretted that they had not wired more extensively in the first instance in view of the higher cost of extensions which they soon desired.

Information regarding heating is available from twenty-five farms. Seven used room heaters only with an average consumption per farm of 247 kWh per annum (costing £1 10s. 10½d.); six used room heaters and irons consuming 289 kWh; seven took electricity for cookers in addition and consumed 868 kWh (£5 8s. 6d.); and five with other combinations of appliances used 321 kWh. Cookers were in use on eight of these holdings, room heaters on twenty-two, water heaters on two, irons on eighteen, and vacuum cleaners on three.

Only six motors of less than 4 h.p. (for such domestic purposes as churning cream) were found in use, the average being 1¾ h.p. with a cost per motor of £9 10s. or £5 9s. 6d. per h.p. On the same farms there were ten motors of over 4 h.p. each.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

McDonald, Johnston & Co., Ltd.—Private company. Registered in Dublin November 9th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of radio, telegraphic, telephonic and television receiving and transmitting instruments, electric switchboards, &c. The directors are: W. C. Johnston and A. McDonald, both of Riversdale, Howth Road, Sutton, Co. Dublin.

H. Cooper & Co. (Hyde), Ltd.—Private company. Registered November 15th. Capital, £500 in £1 shares. Objects: To carry on the business of dealers in radio sets and apparatus, &c. The directors are: H. Cooper and Mrs. F. E. Cooper, both of "Rose Mount," Spring Bank Road, Woodley. Solicitors: H. Bostock & Son, Hyde.

Wall & Attwooll, Ltd.—Private company. Registered November 14th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical, wireless and gas engineers and factors hitherto carried on by Wall & Attwooll, a branch of Electric Lamp Factors, Ltd., at 47/49, Crasswell Street, Portsmouth. The directors are: W. C. Hands, 6/8, Gorleston Street, West Kensington, W.14; T. W. Cond, 6/8, Gorleston Street, West Kensington, W.14; F. G. Wall and H. A. Attwooll (addresses not stated).

Dale & Williams, Ltd.—Private company. Registered November 14th. Capital, £2,500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, and manufacturers, &c. The directors are: A. J. Dale, 169, Green Lane, New Eltham, S.E.9; P. J. Williams, 1, Bow Arrow Lane, Dartford; W. J. B. Reid, 859, Sidcup Road, Eltham, S.E.9. Registered office: 61b, High Street, Sidcup, Kent.

Harrison & Norris, Ltd.—Private company. Registered November 16th. Capital £3,000 in £1 shares. Objects: To acquire the business carried on at 75, The Parade, and 51, Bedford Street, Leamington Spa, as Harrison & Norris, and to carry on the business of manufacturers of and dealers in radio apparatus, gramophone and component parts, records, electrical fittings, scientific instruments, &c. The first directors are: G. Norris, 71, Lillington Road, Leamington Spa, C. Harrison, 12, Portland Street, Leamington Spa, and J. M. McIntosh, 6, Cherry Street, Birmingham. Solicitors: Forsyth, Bettinson and Co., 11 & 12, Bennetts Hill, Birmingham.

Cymric Relay Service, Ltd.—Private company. Registered November 18th. Capital, £1,000 in £1 shares. Objects: To construct and maintain stations for the reception and distribution of radio and/or television signals and waves, &c. The directors are: W. J. Jones, County Road, Porthcawl, Glam, J. S. Enos, 12, Pwllygarth Street, Kenfig Hill, Glam, C. H. Nelson, 3, Garth Street, Kenfig Hill, Glam, and T. J. Nelson, The Cot, Pyle, Glam. Secretary: W. J. Jones. Solicitor: Martin C. Verity, Dunraven Place, Bridgend, Glam.

Inductair Vaporiser, Ltd.—Private company. Registered November 18th. Capital, £5,000 in £1 shares. Objects: To carry on business as engineers, electrical and mechanical manufacturers, repairers of and dealers in machinery of all kinds, magnetos, insulators, conductors, transformers, switchboard and electrical equipment and accessories, motor engineers, &c. The permanent directors are: T. E. Samson, 50, Salisbury Road, Cardiff, and W. E. Hutchison, 21, Park Lane, Cardiff.

J. Akers, Ltd.—Private company. Registered November 18th. Capital, £5,000 in £1 shares (800 cumulative 20 per cent. "A" preference and 720 cumulative 20 per cent. "B" preference). Objects: To acquire the business of an electrical sign manufacturer formerly carried on by the late John Akers and now by his trustees and to carry on the business of sign makers, sign writers (luminous or otherwise), poster writers, advertising specialists, &c. The directors are: W. T. Akers, 95, North Road, Kew Gardens, Surrey (chairman), W. Akers, 53, West Park Avenue, Kew Gardens, and S. Docwra, 8, Queen Street, Cheapside, E.C. Solicitors: Whittington, Son & Barham, 120, Bishopsgate, E.C.2.

Golden Voice Radio, Ltd.—Private company. Registered November 18th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, telegraph and telephone apparatus, to let on hire or hire-purchase any goods, &c. The subscribers (each with one share) are: P. H. Montgomery, 46, Mayfield Road, Moseley, Birmingham, and F. W. Salter, 48, Hawthorn Road, New Oscott, Birmingham. Secretary (pro tem): F. W. Salter. Registered office: Matchless Works, 2, Fallows Road, Sparkbrook, Birmingham.

Darlington Wireless Relay Service, Ltd.—Private company. Registered November 17th. Capital, £12,020 in 8,000 7 per cent. cumulative redeemable preference shares of £1 and 16,080 ordinary shares of 5s. each. Objects: To acquire from Rediffusion, Ltd., an agreement, dated August 3rd, 1933, with the Darlington Corporation relative to broadcast relay operations, to establish, maintain and develop services for the relaying of radio and television programmes, news and subject matter to subscribers and others in Darlington and elsewhere. The directors are: Sir Richard A. Pease, Prior House, Richmond, Yorks, W. M. C. Hustler, Mowden, Darlington, R. J. Mounsey, High Lynhams, Blackwell, Darlington, C. C. Darling, Corner House, Cleasby, Yorks, E. Puttock, Green Wickets, Cottingham, Yorks, and C. Perkins, 22, Grove Street, Newcastle-on-Tyne. Registered office: Bush House, Aldwych, W.C.2.

Returns of Electrical Companies

Llandudno & Colwyn Bay Electric Railway, Ltd.—Particulars filed of £100,000 6 per cent. cumulative income debenture stock and premium of 5 per cent. (being a conversion of £100,000 prior lien debenture stock, secured by trust deed dated July 30th, 1926), authorised pursuant to scheme of arrangement sanctioned by Order of Court dated July 28th, 1933, and covered by trust deed dated October 23rd, 1933, the amount of the present issue being £25,000. Property charged: Property set out in the original deed. Trustees: Trust Union, Ltd.

Bolton Electrical Traders, Ltd.—Mortgage debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 4th, 1933, to secure all moneys due or to become due from the company to Williams Deacon's Bank, Ltd.

R. J. Raphael & Co., Ltd.—Debenture dated October 28th, 1933, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. A. Raphael, 65, Brook Dale, New Southgate, N.11.

General Electric Co., Ltd.—Satisfaction in full on September 30th, 1933, of 5 per cent. mortgage debenture stock authorised September 11th, 1930, secured by trust deed dated October 14th, 1930, and registered October 21st, 1930.

Solamite Signs, Ltd.—Debenture dated October 18th, 1933, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. M. Pirie & Co. (London), Ltd., 26/8, Little Manor Street, S.W.4.

Suflex, Ltd.—Particulars filed of £500 debentures, authorised November 6th, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Young & Wildsmith, Ltd.—Particulars filed of £5,000 debentures authorised October 4th, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £4,500.

Burrell Radio, Ltd.—The nominal capital has been increased by the addition of £1,800 beyond the registered capital of £700. The additional capital is divided into 1,800 ordinary shares of £1.

Neon Installations, Ltd.—The nominal capital has been increased by the addition of £4,000 beyond the registered capital of £1,000. The additional capital is divided into 4,000 6 per cent. participating preference shares of £1 each. The 1,000 ordinary shares have been subdivided into 10,000 ordinary shares of 2s. each.

Pirelli-General Cable Works, Ltd.—Satisfaction in full on September 14th, 1933, of trust deed dated July 1st, 1930, and registered July 19th, 1930, securing debenture stock. (According to the register of mortgages, the trust deed registered July 19th, 1930, originally secured £600,000 debenture stock.)

Standard Telephones & Cables, Ltd.—Capital, £2,000,000 in £1 shares. Return dated July 11th, 1933. All shares taken up. £906,000 paid, £1,094,000 considered as paid. Mortgages and charges, nil.

Italian Electrical Imports

THE increased share of the United Kingdom in various classes of electrical machinery and appliances imported into Italy during last year is commented upon in a recent Department of Overseas Trade report, dated July last, on economical conditions in that country (Stationery Office, price 5s.).

Imports of electrical generators and motors amounted to 970 tons valued at 23.0 million lire, against 1,444 tons valued at 30.1 million lire in 1931. Germany continued to be the chief supplier, but last year the United Kingdom's share of the market was 124 tons against 74 tons in 1931. Germany supplied 567 tons in 1932, and 825 tons (nine tons on reparations account) in 1931. The United Kingdom was the only country which increased her share of the market in these goods last year, imports from all other countries falling off very considerably.

The United Kingdom did not figure in the returns of imports of electrical transformers last year, and, as in the previous year, Germany was the chief supplier; imports fell off last year to 174 tons, valued at 3.3 million lire, against 232 tons, valued at 4.8 million lire in 1931. Accumulator imports amounted to 115 tons valued at 0.9 million lire, against 390 tons valued at 4.5 million lire in 1931.

Purchases of other electrical machinery, apparatus and parts also declined last year, amounting to only 1,156 tons valued at 40.7 million lire, against 1,342 tons (five tons on reparations account) valued at 47.9 million lire, in 1931. Imports from the United Kingdom increased from 119 tons to 143 tons, while Germany supplied 662 tons in 1932 and 698 tons in 1931. With the exception of Belgium, whose share was insignificant (four tons), the United Kingdom was the only country to show an increase of trade under this heading last year.

Shardlow Electric Wires, Ltd.—Satisfaction to the extent of £1,304, of February 10th, 1933, of mortgage debenture dated October 1st, 1930, and registered October 4th, 1930. (Notice filed November 7th, 1933.)

H. G. Richardson, Ltd.—S. G. Best, Avon Chambers, Castle Street, Salisbury, was appointed receiver and manager on October 28th, 1933, under powers contained in debenture dated January 28th, 1932.

S. H. Heywood & Co., Ltd.—Capital, £34,000 in 18,000 preference shares of £1 and 32,000 ordinary shares of 10s. Return dated June 7th, 1933. All shares taken up. £20,000 10s. paid on 18,000 preference and 4,001 ordinary shares. £13,999 10s. considered as paid on 27,999 ordinary shares. Mortgages and charges, nil.

W. H. Allen, Sons & Co., Ltd.—Capital, £500,000 in £1 shares. Return dated July 31st, 1933. 408,750 shares taken up. £58,757 paid. £349,993 considered as paid. Mortgages and charges, £154,673.

Midland Electric Corporation for Power Distribution, Ltd.—Capital, £1,000,000 in 200,000 7 per cent. preference and 800,000 ordinary shares of £1 each. Return dated April 11th (filed September 13th), 1933. 200,000 preference and 700,000 ordinary shares taken up. £834,605 paid on 134,605 preference and 700,000 ordinary shares. £65,395 considered as paid on 65,395 preference shares. Mortgages and charges, nil.

Sterling Telephone & Electric Co., Ltd.—Capital, £65,000 in 49,650 preference and 15,350 ordinary shares of £1. Return dated August 18th, 1933. 39,500 preference and 15,350 ordinary shares taken up. £24,500 paid. £30,350 considered as paid. Mortgages and charges, nil.

Rawlings Bros., Ltd.—Capital, £100,000 in 30,000 preference and 70,000 ordinary shares of £1 each. Return dated August 8th, 1933. 21,903 preference and 61,401 ordinary shares taken up. £83,304 paid. Mortgages and charges, nil.

Standage Power Couplings, Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £1,000. The additional capital is divided into 1,000 7 per cent. cumulative preference shares of £1 each.

Olympia Radio, Ltd.—Debenture dated October 1st, 1933, to secure £1,800, charged on the company's property, present and future, including uncalled capital (subject to debentures dated April 23rd, 1932, and June 6th, 1932). Holder: Mrs. S. Kremner, "Ashdown," Middleton Road, Crumpsall, Lancs.

Kadette, Ltd.—R. M. Peat, 11, Ironmonger Lane, E.C.2, was appointed receiver and manager on November 10th, 1933, under powers contained in debenture dated April 5th, 1933.

British Clarion Co., Ltd.—F. Everett, 78, Old Broad Street, E.C., was appointed receiver and manager on November 9th, 1933, under powers contained in debenture dated October 27th, 1931.

Chadburns (Ship) Telegraph Co., Ltd.—Capital, £120,000 in 60,000 preference and 60,000 ordinary shares of £1. Return dated July 20th, 1933. All shares taken up. £100,000 paid on 50,000 preference and 50,000 ordinary shares, £20,000 considered as paid on 10,000 preference and 10,000 ordinary shares. Mortgages and charges, nil.

South Metropolitan Electric Light & Power Co., Ltd.—Capital, £1,100,000 in 150,000 cumulative 1st preference, 100,000 cumulative 2nd preference, and 850,000 ordinary shares of £1. Return dated April 18th (filed September 1st), 1933. All 1st and 2nd preference and 600,000 of the ordinary shares taken up. £492,132 paid on 144,632 1st preference, 100,000 2nd preference, and 247,500 ordinary shares. £357,868 considered as paid on 5,368 1st preference and 352,500 ordinary shares. Mortgages and charges, £500,000.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in 20,000 ordinary and 15,000 preference shares of £1. Return dated June 9th, 1933. 15,000 ordinary and 11,000 preference shares taken up. £26,000 paid. Mortgages and charges, nil.

Playford & Son, Ltd.—Capital, £2,000 in £1 shares. Return dated July 19th, 1933. 1,214 shares taken up. £1,214 paid. Mortgages and charges, £350.

Power Specialities, Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 ordinary shares beyond the registered capital of £2,000.

City Notes

Electric & Musical Industries, Ltd.—Presiding at the annual meeting held on November 17th, Mr. A. Clark (chairman) in the course of his speech said that this time last year their trade in the British radio industry was moving upwards, but shortly after their meeting, price-cutting became rampant, due to large unsold stocks. The increase in sales was not maintained and the home factories were not able to counteract this setback by an increase in export trade. The policy of reorganisation coupled with economies had been pursued, and it was to this work that they must attribute the reduction in the trading losses. In May and June a distinct change came about and sales began substantially to increase, but the upward movement arrived too late in the trading year to affect the present figures. This advance was also noticeable in exports and in the trade in some foreign countries, and it had since been maintained. The manufacture of radio receiving sets and radio-gramophones had largely helped to fill the gap in the factories caused by decreasing gramophone work, and of the two businesses radio, in England, was now the greater. Regarding the current year, they were still faced with a series of situations at home and abroad which had a direct bearing upon their trading profits, but they were now operating at a profit, and if conditions remained as they had been since last May, then they felt that they would have turned the corner.

The Telsen Electric Co., Ltd.—The annual meeting was held at the Grand Hotel, Birmingham, on November 14th. The report and accounts for the year to June 30th, 1933, were unanimously adopted and appreciation was expressed of the efforts made by Mr. A. W. Macnamara in order to help the company, both during the year under review and with regard to the financing of the current year's trading. Colonel C. E. Jewels was re-elected a director, and Mr. W. Henderson-Cleland, chairman of S. Smith and Sons (Motor Accessories), Ltd., and Mr. A. A. Rowse, until recently one of the managing directors of Morris Motors, Ltd., were unanimously elected to the board.

Grosvenor Electric Batteries, Ltd., reports a net profit for the year ended June 30th last of £3,581, as compared with £12,106 in the preceding year. An interim ordinary dividend of 5 per cent. absorbed £3,992, and the carry-forward is reduced from £861 to £450. In the previous year a dividend of 10 per cent. was paid on smaller capital, plus a share bonus of 20 per cent. During the year the issued share capital was increased from £79,846 to £100,000. The new capital has been utilised in making extensions to the existing buildings, plant and machinery at the company's factory at Watford. Meeting: November 27th.

R. A. Lister & Co., Ltd.—Presiding at the annual meeting held on November 17th, Mr. A. A. Lister said that the results for the year under review were satisfactory. Orders on hand and the better tone prevailing in the home and overseas

The Diesel-electric tug *Lectro* passing under Westminster Bridge. Some details of working tests are given on page 752, from which it will be seen that the estimates were fully justified

markets justified the board in sending the managing director (Mr. P. Lister) on a voyage around the world to develop trade and interest for the company.

The Radio Corporation of America and its subsidiaries show a gross income of $41,744,550 for the first nine months of the current year, a decrease of $9,052,250, as compared with the corresponding period of 1932. After meeting interest, depreciation, amortisation of patents, &c., there is a deficit of $1,793,370, which reduces the surplus at September 30th to $8,057,814.

The Delhi Electric Supply & Traction Co., Ltd., has declared an interim dividend of 4 per cent., tax free (same).

Stocks and Shares

TUESDAY EVENING.

THE dollar delirium is the main factor that controls, for the time being, the majority of price movements in Stock Exchange securities. Between the two opposite opinions that President Roosevelt is a heaven-sent deliverer of his country, and, on the other hand, a reckless gambler with the financial fortunes of the U.S.A., there is plenty of room for other opinions which take a less extreme view than either of those mentioned. Stock Exchange business has been held in leash by the uncertainties prevailing in New York, and in the City it has been asked, rather impatiently, for how long this country in particular, and the rest of Europe in general, will consent to being held down in the matter of trade by economic experiments directed from Washington. Abundance of money is still awaiting employment, but people are afraid to venture very far, either in the investment or in the speculative markets. Not only the private investor experiences difficulty in placing his capital to advantage. The banks, insurance companies and finance houses are equally perplexed with the same problem. For this reason, prices of investment securities remain firm, and if there is no buying worth mentioning, the volume of selling is equally modest. When Stock Exchange business is quiet, the inevitable tendency of prices is downward. Reference to our lists will show the very unusual feature of there being more falls than rises.

Central Electricity 4½ per cent. stock of 1951-1973 is 1½ down, at 108. London Transport issues are keeping at their previous levels. London Power 5 per cent. debenture is down a point at 110¼.

Metropolitan Electric Supply

The issue by the Metropolitan Electric Company of 160,000 new ordinary shares of £1 each, at £2 per share, has given rise to a fair amount of business in the new shares. The price is quoted at 12s. premium, being about sixpence per share less than that of the old shares. The latter carry a final dividend in respect of the current six months, but the new shares can be transferred free of stamp and fee. The prices of the two issues are, therefore, in close correspondence with each other. To those holders who are able to take up their proportion it may be suggested that this is the better course to pursue, rather than selling the rights, in that the company is likely to continue payment of 10 per cent. dividends on the ordinary shares. This would give 5 per cent. on the shares obtainable in right at 40s. Nevertheless, it is certainly tempting to take a premium of 12s., or thereabouts, on the new shares and to regard the money as an extra dividend upon which no tax is payable.

Electricity Supply Shares

Amongst the ordinary shares of the other companies, the tendency has been a little easier. County of London reacted to 55s. Trifling falls have occurred in North Eastern preference and Electric Supply Corporation ordinary. Electric Distribution of Yorkshire shares are 1/8 down. North Metropolitans shed 9d., going back to 59s. 9d. Hendons have recovered to 56s. North Somersetshire ordinary are better at 37s. 6d. Dealings will begin this week in the newly issued West Devon Electrics. In the foreign group, the drop of 2s. 6d. lowered Whitehall Electric Investment preference to 17s. 6d. The shares have been rather pressed for sale upon a market not too well supplied with buyers. Atlas are dull at 8s. 3d., British Power and Light, also, at 20s.

Cables and Wireless

The receipts index number of Imperial & International Communications for October was read favourably. The number is 72.1, which shows a gain of 4.2 on the previous month, although in October last year the figure was 73.2. The index number for October is the highest during the present year. Prices of the stocks had been dull before the monthly figures appeared, but the latter had a strengthening effect. As soon as the buyers—or the bears—had helped themselves, prices turned heavy, and the "A" ordinary at 23 shows a fall of 2. Globe Telegraph ordinary at 10 are 5s. lower, and Great Northern Telegraphs at 31¾ are 15s. down. There has been a certain amount of realisation in Marconi Marines, and, as a result, the price receded ¼ to 26s. 3d. Anglo-American Telegraphs continue to advance. American Telephone & Telegraph shares at 114½ show a dollar rise, the regular quarterly dividend of 2¼ per cent. being again declared. Some people had expected a reduction in the rate. Internationals keep steady at 14¼. Orientals are an exceptionally good market at 3 1/16. Telephone Properties at 21s. 3d. are ex the 2 per cent. dividend paid on the Tuesday in this week.

Manufacturing and Equipment

The market in the shares of manufacturing and equipment companies appears to be a little disappointed by the absence of interim dividends on the ordinary shares of Siemens as well as Johnson & Phillips. As mentioned last week (ELECTRICAL REVIEW, page 720) neither of these companies paid any interim dividend a year ago. This time, however, it seems to have been expected that one or other would make a distribution, however modest, in the way of an interim dividend. Siemens, which shed 2s. 6d. last week, are down a further florin, to £1. Johnson & Phillips remain dull at 19s. 6d. Of the shares more particularly affected by American influences (according, at any rate to tradition), Associated Electrical Industries ordinary, at 17s. 9d., show 1s. fall, and General Electric ordinary, at 42s. 9d., have receded 1/16. A fair amount of activity in Electric & Musical Industries has left the price rather easier at 15s. Callenders, Henleys and British Insulated have dropped. British Aluminium ordinary are 1/16 lower, and the market as a whole gives no particular sign of vitality. The jobbers complain that nobody wants to buy, and nobody wants to sell: the result being that business has fallen away to a great extent, and, in such circumstances, the disposition, as already observed, is for prices to dwindle.

Crompton Parkinson ordinary make a bright exception with a jump of 4s. 3d. to 1½. The shares are in short supply, and the price responded sharply to a little demand.

Babcock & Wilcox, at 38s. 9d., have lost the improvement which they gained a week ago. Vickers and other shares of similar character have sympathies with the general condition of dullness. The rubber share market continues in the state of somnolence recorded here last week. It will be observed that India Rubber preferred ordinary shares have entered our price lists. These, and the 5½ per cent. preference, are quoted at 16s. 3d. The company's debentures are better at 95½.

Dollar Stocks

Mexico Tramways common shares have dropped to 6. The company's 5 per cent. first mortgage bonds are 4 lower at 27½. Brazilian Tractions are easier at 10¾. Of the Canadian dollar stocks, Montreal Lights are quoted at 32, and Shawinigans at 16½. Amongst U.S.A. dollar issues, Western Unions fell to 50, but recovered to 55½. It will be readily understood that the prices of a good many American issues are nowadays somewhat nominal.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1931.	1932.	Price, Nov. 21.	Rise or Fall.	Yield. p.c. £ s. d.
Bournemouth and Poole	1	15	15	78/3	—	3 17 0
Brompton Ordinary	1	8½	7	34/–	—	4 2 4
Charing Cross Ordinary	1	8½	7	34/6	—	4 1 2
Chelsea	1	8¾	7	33/6	—	4 3 7
City of London	1	10	10	35/–	—	4 0 0
Clyde Valley	1	7	7	40/–	—	3 10 0
County of London...	1	10½	10½	55/–	—¼	3 12 8
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	46/3	—¼	3 18 0
Elec. Supply Corporation ...	1	11	11	79/6	—6d.	2 15 6
Kensington Ordinary	1	8	7	34/–	—	4 2 4
Lancs Light and Power	1	7	7	36/3	—	3 17 2
London Electric	1	9	7	34/6	—	4 1 2
Metropolitan	1	10	10	52/6xr.	—	3 16 0
Midland Counties	1	7	7	37/–	—	3 15 8
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary...	1	6	6	34/–	—	3 10 8
Do. 7% Pref.	1	7	7	34/0	—6d.	4 2 4
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	13¾	—	4 8 11
North Met. Elec. 6% Pref. ...	1	6	6	30/–	—	4 0 0
St. James' and Pall Mall ...	1	8	7	34/–	—	4 2 4
Scottish Power	1	8	8	38/9	—	4 2 6
South London	1	8½	7	34/6	—	4 1 2
Westminster Ordinary	1	8½	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	17/6	—½	8 11 6
Yorkshire Elec.	1	8	8	46/3	—	3 9 3

PUBLIC BOARDS.

Central Electricity, 1950–70 ...	Stock	5	5	114	—	4 7 6
Do. 1951–73 ...	,,	4½	4½	108	—1½	4 3 4
Do. 1963–93 ...	,,	—	3½	93	—	3 15 3
London & Home Counties, 1955–75	,,	4½	4½	110	—	4 1 10
London Passenger Transport, A...	,,	—	4½	117	—	3 17 0
Do. do. B...	,,	—	5	121	—	4 2 8
Do. do. C...	,,	—	—	81	—	—

TELEGRAPH AND TELEPHONES.

American Tel. & Tel.	$100	9	9	114½	+1	7 17 3
Anglo-Am. Tel. Pref.	Stock	6	6	115½	—	5 4 0
Do. Def.	,,	1½	1½	30	+½	5 0 0
Cables & Wireless 5½% Pref. ...	,,	2¾	2¾	71½	—1	3 17 0
Do. A 7½% Ord.	,,	Nil	Nil	23	—2	—
Do. B Ord.	,,	Nil	Nil	10½	—½	—
Globe Tel. and T. Ord.	10	Nil	2½	10	—½	2 10 0
Do. do. Pref.	10	6	6	12½	—	4 16 0
Great Northern Tel.	10	20	20	31¾	—¾	6 6 0
Marconi-Marine	1	10	7½	26/3	—½	5 14 3
Oriental Telephone Ord.	1	12	12	3 1/16	+¼	*3 16 4

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	3/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	475xd.	—	—
Do. do. Pref. Ord.	,,	8	8	144½xd.	+3	5 10 9
Brazil Traction	100	—	—	10¾	—¼	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	108	—	4 17 0
Mexico Trams, 5% Bonds ...	—	5	5	27½	—4	18 3 8
Mexican Light Common	100	Nil	Nil	7¼	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	45	—	11 2 8
Victoria Falls Ord.	1	15	20	5 ½	—¼	3 19 0
Yorkshire (West Riding) ...	1	Nil	Nil	15/–	—	—

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	4	4	17/9	—1/–	4 10 4
Do. Pref.	1	8	8	33/3	—	4 16 6
Babcock & Wilcox	1	14	9	38/9	—¼	—
British Aluminium Ord.	1	5	5	28/6	—1/6	3 10 2
British Insulated Ord.	1	15	15	72/6	—¼	4 2 8
Brush Ord.	Stock	Nil	Nil	40	—	—
Callender's...	1	15	15	65/–	—3/3	4 12 4
Do. 6½% Pref.	1	6½	6½	31/3	—	4 8 2
Crompton Parkinson Ord. ...	5/–	22½	—	22/6	+4/3	5 0 0
Do. 8% Pref.	1	8	8	31/3	—	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/–	—	—
Enfield Cable Ord.	1	25	25	96/–	—	5 5 5
English Electric	1	Nil	Nil	8/3	—6d.	—
Do. do. Pref.	1	Nil	Nil	12/6	—	—
Ever Ready	5/–	35	35	30/–xd.	+3d.	5 16 8
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/–	—	4 1 2
Do. Ord.	1	8	8	42/9	—¼	3 14 8
Henley's	1	30	30	6 ¾xd.	—¼	4 14 8
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	16/3	—	—
Johnson & Phillips	1	5	5	19/6	—	5 2 7
Siemens Ord.	1	7½	6½	20/–	—2/–	—
Telegraph Construction	£1	Nil	Nil	28/9	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1932

2070. "Electric converting apparatus." E. Marx. January 22nd, 1931. (400634.)

4994. "Arrangements for converting the frequency of alternating current by means of controlled arc rectifiers." Siemens-Schuckertwerke Akt.-Ges. February 20th, 1931. (400635.)

5474. "Register elements for use in electric furnaces." Birmingham Electric Furnaces, Ltd. (Electric Furnace Co.). February 24th, 1932. (400605.)

8172. "Electric tachometer." Dr. B. Lange, A. Schwarz and General Electric Co., Ltd. March 18th, 1932. (400594.)

8525. "Remote control of reversible electric motors." Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. March 22nd, 1932. (400606.)

9528. "Terminals of accumulators, batteries, and the like." A. P. Welch. April 2nd, 1932. (400669.)

11052. "Apparatus for producing electric sparks for use in spectrum analysis." W. C. Heraeus Ges. April 18th, 1931. (400607.)

11719. "Apparatus for the electrolytic manufacture of sheet metal." E. Kelsen and E. Ausnit. April 29th, 1931. (400591.)

11736. "Electric synchronising systems." Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett and L. E. Q. Walker. April 23rd, 1932. (400610.)

11809. "High tension and grid bias wireless batteries." A. R. Pappadakis and N. J. Sivess. April 25th, 1932. (400600.)

11875. "Sand and like interceptors or dirt traps, more particularly intended for use in electric earthing tubes." K. W. Hedges. April 25th, 1932. (400620.)

12120. "Train lighting, heating and like electrical installations." J. Stone & Co., Ltd., and Sir J. T. Prestige. April 27th, 1932. (400625.)

12140. "Electron-discharge devices." Ferranti, Ltd., R. W. Sutton and T. C. Black. April 27th, 1932. (400648.)

12146. "Scanning apparatus for electro-optical systems." Electrical Research Products, Inc. May 21st, 1931. (400626.)

12156. "Condenser microphones." Telephone Manufacturing Co., Ltd., and B. J. Burridge. April 27th, 1932. (400629.)

12252. "Electrical measuring instruments." C. V. Drysdale. April 28th, 1932. (400651.)

12253. "Electrical measuring instruments of the electro dynamometer type." C. V. Drysdale. April 28th, 1932. (400652.)

12254. "Electrostatic voltmeters." C. V. Drysdale. April 28th, 1932. (400653.)

12255. "Electrical indicating instruments." C. V. Drysdale. April 28th, 1932. (400654.)

12433. "Remote control of railway points and signals or the like." L. H. Peter, J. Woodford and Westinghouse Brake and Saxby Signal Co., Ltd. April 30th, 1932. (400659.)

12485. "Secret combination electric switches." S. Z. Milledge. May 1st, 1933. (400670.)

12601. "Provision of heating apparatus on petrol-electric and like vehicles." Sir W. G. Armstrong-Whitworth & Co. (Engineers), Ltd., A. Orton and C. M. Beckett. May 2nd, 1932. (400673.)

12610. "Arc-welding apparatus." British Thomson-Houston Co., Ltd. May 1st, 1931. (400675.)

12769. "Combined voltage regulator and magnetic cut-out circuits." A. C. Lock and Simms Motor Units, Ltd. May 3rd, 1932. (400679.)

12790. "Vehicle headlamps, searchlights, and other light beam projecting lamps." C. J. Guy. May 4th, 1932. (Cognate application 31173/32.) (400680.)

13348. "Wireless telegraph and telephone apparatus." Siemens Bros. & Co., Ltd., M. Reed and W. H. Andrews. May 9th, 1932. (400687.)

13417. "Recovery of energy in an electric-current distributing system." Akt.-Ges. Brown, Boveri et Cie. December 29th, 1931. (400688.)

13685. "Arc lamps." R. H. Cricks, P. Rigby and R. Rigby, Ltd. May 12th, 1932. (Cognate application 15287/32.) (400692.)

13814. "Inductance coils." V. G. Van Colle and Ward & Goldstone, Ltd. May 13th, 1932. (400693.)

14387. "Wireless receiving apparatus." British Radio Corporation, Ltd., and R. S. Bunting. May 20th, 1932. (400696.)

14762. "Electrical water heaters." A. Wright. May 24th, 1932. (400700.)

15077. "Isolating switches for use with overhead electric lines." J. E. Stewart and R. T. Norton. January 21st, 1933. (400702.)

15430. "Electric heaters." F. S. Grogan. May 31st, 1932. (400704.)

15967. "Metal-clad electric switchgear." General Electric Co., Ltd., and C. C. Garrard. June 6th, 1932. (400707.)

16222. "Protective systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. June 8th, 1931. (400710.)

16413. "Junction boxes and the like for electricity distributing systems." F. C. Blackwell & Co., Ltd., and F. Firth. June 10th, 1932. (400711.)

16854. "Universal induction regulators." J. Sousedik. June 14th, 1932. (400714.)

17182. "Withdrawable electric switchgear." General Electric Co., Ltd., and C. C. Garrard. June 17th, 1932. (400716.)

17646. "Apparatus for electrostatic deposition of particles suspended in gases." English Electric Co., Ltd., Whessoe Foundry & Engineering Co., Ltd., W. Donnelly and A. G. Grant. June 22nd, 1932. (400719.)

18047. "Ventilation of electrical or other machinery or apparatus." Heenan & Froude, Ltd., and F. T. Wilesmith. June 27th, 1932. (400722.)

18402. "Electromagnetic driving-mechanism, particularly suitable for actuating a rheostat switch." British Thomson-Houston Co., Ltd., and E. B. Tuppen. June 29th, 1932. (400723.)

18707. "Terminal units for electrical apparatus." W. A. Harlick. July 2nd, 1932. (400725.)

19006. "Instruments for the measurement of electrical resistance." Evershed & Vignoles, Ltd., and G. B. Rolfe. July 5th, 1932. (400728.)

19644. "Terminal connection for sparking-plug leads." H. M. Pyke and N. E. Shackleton. July 12th, 1932. (400731.)

20273. "Telephone systems." General Electric Co., Ltd., and A. F. Jones. July 18th, 1932. (400732.)

20339. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. July 18th, 1932. (400733.)

20866. "Electric kettles and other electrically heated vessels." Eveson Bros. (1928), Ltd., and J. C. Eveson. July 25th, 1932. (400738.)

21342. "Earth-contacting devices for use in wireless and other systems." T. G. Farish. July 28th, 1932. (400739.)

22704. "Fixing devices for use in connection with electric tumbler switches, bell-pushes, and socket couplings." J. A. Crabtree. August 13th, 1932. (400746.)

24461. "Rubbing-down attachment for portable electric grinding machines." J. Haigh. November 8th, 1932. (400754.)

24845. "Electric lamps." General Electric Co., Ltd. November 6th, 1931. (400756.)

26164. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 28th, 1931. (400764.)

29254. "Transmitting or rectifying electric discharge valves." International General Electric Co., Inc. October 19th, 1931. (400768.)

29744. "Control system for low-pressure gaseous electric discharge apparatus." Akt.-Ges. Brown, Boveri et Cie. October 24th, 1931. (400772.)

30788. "Electric resistance heating apparatus for hot-water bottles." Dr. R. Eder. November 11th, 1931. (Cognate Application 30789/32.) (400777.)

31859. "Electrical conductors." Kabelwerk Vacha Akt.-Ges. January 16th, 1932. (Cognate applications, 31860/32, 31861/32, 31862/32, 31863/32, 31864/32.) (400781.)

32190. "Electric drives for oscillating systems such as pendulums." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges.). November 14th, 1932. (400783.)

34685. "Direct-current motor control." Forges & Ateliers de Constructions Electriques de Jeumont. December 11th, 1931. (Addition to 386009.) (400792.)

1933

299. "Electric indicating devices for sound waves." F. Von Opel. January 13th, 1932. (400796.)

730. "Electric cables." International General Electric Co., Inc. January 9th, 1932. (400802.)

976. "Electric thermal time-delay relays." International General Electric Co., Inc. January 11th, 1932. (400804.)

1456. "Electric discharge devices." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. January 15th, 1932. (400806.)

1917. "Electrical transformers." English Electric Co., Ltd., and L. W. Bamford. January 20th, 1933. (400811.)

7199. "Electric discharge tubes for the emission of light." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 10th, 1932. (400835.)

8527. "Electric current-interrupting devices." Westinghouse Electric & Manufacturing Co. April 15th, 1932. (400838.)

10321. "Device for the adjustment from the exterior of pointers arranged in the interior of the casing of electrical and other apparatus." Landis & Gyr Akt.-Ges. June 1st, 1932. (400847.)

17557. "Supply and control systems for electric motors." British Thomson-Houston Co., Ltd. June 30th, 1932. (400886.)

19556. "Ultra-short-wave receiving systems and thermionic valves for use therein." Telefunken Ges. für Drahtlose Telegraphie. July 8th, 1932. (400897.)

22745. "Electro-optical apparatus for indicating acoustic signals and other sounds." E. Leitz Ges. September 2nd, 1932. (400902.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 15th :—

Keystone (lettering and design). No. 535351. Class 8. Apparatus for use in connection with radio-telegraphy and telephony.—Peto Scott Co., Ltd., 77, City Road, E.C.1.

J. L. Baird. No. 540041. Class 8. Complete receiving sets for television by wireless transmission.—Television, Ltd., 133, Long Acre, W.C.2.

Permarec. No. 544959. Class 8. Sound-recording, reproducing and amplifying apparatus.—Musikon, Ltd., 19, Lisle Street, Leicester Square, W.C.2.

Cleco. No. 542998. Class 8. Electric transformers and battery-charging apparatus.—G. S. Jinks, trading as the Cecil (Leicester) Electrical Co., 40, St. Peter's Street, Highcross Street, Leicester.

Cavalcade. No. 544897. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Radio Maintenance, Ltd., 115, High Street, Chesham, Bucks.

Margo (lettering and design). No. 545058. All goods in Class 8.—C. & E. Marquis, Ltd., Buchanan Buildings, 24, Holborn, E.C.1.

Quicksan. No. 544277. Class 18. Electric grills, toasting stoves and cooking stoves; and Scotoloc. No. 543519. Class 50. Moulded articles made wholly or principally of cellulose or cellulose compounds.—William McGeoch & Co., Ltd.

Internal Combustion Engines in Belgium

A report on the market for internal combustion engines in Belgium has just been issued by the Department of Overseas Trade. This gives a comprehensive survey of the present position, noting, *inter alia*, that the market is restricted by the general availability of electricity supply. It states that German firms are well established in the business.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Atherstone.—Houses (74) (£21,540); Johnson & Newton, Ltd., builders, Coventry. Houses (100), Cottagers Place; W. R. Kemp & Sons, builders, 131, Clifton Road, Birmingham.

Ayr.—Bus station; burgh surveyor.

Earnes.—Block of flats, Sheen Lane, for W. J. Kieffer.

Birmingham.—Baptist Church, Yardley Wood (£6,000), with electrical work; F. Nightingale, secretary, 108, Sandmere Road, Yardley Wood.

Blackburn.—Conversion of Parish Church into a Cathedral (£150,000) with electrical work; W. A. Forsyth, architect, 12, Stratford Place, London, W.1.

Blackpool.—Houses (81), Grasmere Road; W. Hornby. Houses (49), Leckhampton Road; G. Hodgson & Sons, Ltd. Houses (55), North Drive; R. & H. Fletcher. Houses (50), Repton Avenue; R. Fielding & Son. Houses (20), Senior Avenue; M. E. Senior & Son. Houses (32), Ventnor Road; A. & G. Fletcher.

Boston.—Nurses' home, X-ray rooms, &c., for the Hospital Committee (£6,000); secretary.

Bradford-on-Avon.—Houses (30), Bath Road, for the Manor Building Co.

Bristol.—Houses (600), Cote Farm Estate; W. Rossiter, Stoke Bishop.

Bromley.—Extensions, Bromley and Chislehurst Maternity Hospital (£2,700); governors.

Caernarvon.—Cinema, Bangor Street, for Captain W. E. Pritchard; W. & H. Jones, builders, Llanbedrog, Pwllheli.

Caithness.—Schools, Lybster (£18,000), and Thurso, for E.C.; clerk, Education Committee, Thurso.

Cardiff.—Houses, Lansdowne Road and Cowbridge Road; W. G. Chilcott.

Castle Bromwich (NEAR BIRMINGHAM).—Houses (59), Hansons Bridge Road, for Excelda Housing Society, Ltd., 308, Broad Street; Henry Boot & Sons, Ltd., builders, 152, Moore Street, Sheffield. Extensions, Holdern, Mason & Edwards, Woodlands Farm Road (£5,000), with electrical work; W. C. Skinner, builders, Birchfield, Birmingham.

Cheshire.—Schools, Eastham, for County E.C.; county architect, Chester.

Chester.—Junior school for City E.C.; C. Greenwood, city surveyor, 43, Northgate Street.

Cumnock (AYRSHIRE).—Houses (200); burgh surveyor.

Darlington.—Houses, Bensham Road, for Bussey and Armstrong, builders, Brinkburn. Houses, Yarm Road; W. Lyall, architect, 19, Victoria Road. Houses (41), Zetland Street; Dunn and Dunwell, builders, Arden Street. New out-patients' department for the Memorial Hospital (£12,000); R. Blackett & Sons, builders, 63, Bondgate.

Derbyshire.—Extensions, Hurst House, Chesterfield, for Grammar School Governors; G. H. Widdows, county architect, Derby.

Erdington (NEAR BIRMINGHAM).—Offices and shops, High Street, for the Brittanic Assurance Co., Ltd., Broad Street corner, Birmingham (£8,000), with electrical work; Cox, Woodcoat & Taylor, builders, Wylde Green, Sutton Coldfield.

Essex.—Two secondary schools, Dagenham, for County E.C. Senior school, Sawyers Hall Lane, Brentwood (£30,000), and school centre, Malden (£5,000); county architect, Chelmsford.

Farnborough (HANTS).—Post office, for H.M. Office of Works, King Charles Street, London, S.W.

Fenton (STAFFS).—Houses (34) and shops, Victoria Square; Col. H. Clive.

Fife.—Houses (30), Dundonald, Cardenden; Wm. Williamson & Hubbard, architects, Kirkcaldy.

Gainsborough.—Additional houses, Ropery Road; U.D.C. surveyor.

Glasgow.—Shops, Annulree Street; Lynn Proofing Co., Ltd. News film theatre, Central Station, for the L.M.S. Railway Co.; Alistair MacDonald, architect.

Grantham.—Power house extensions for Ruston & Hornsby, Ltd.; Rudd & Son, Ltd., builders.

Hampton (MIDDLESEX).—Houses (32), Lawrence Road; J. E. Purdie.

Handsworth (BIRMINGHAM).—Rebuilding, Albion Cinema, Hollyhead Road (£25,000), with electrical work; Allen & Co., builders, Vaughton Street, Birmingham.

Havering (ESSEX).—Conversion of Havering Court into large ballroom, &c., for C. A. Hopkins.

Hayes (KENT).—Station and block of shops (£14,000), for the Southern Railway Co.; engineer, Cannon Street Station.

Hednesford.—Houses (259), Prairie Farm; A. J. Fieldhouse, builders, Pye Green Road.

Huddersfield.—Re-erection of mill, Colne Bridge, for L. B. Holliday & Co., Ltd.

Huntingdon.—Secondary school, St. Neots, for County E.C.; director of education.

Irvine (AYRSHIRE).—Houses (200); burgh surveyor.

Kent.—Nursery for the Thanet Institution (£5,500); clerk, Maidstone. School, Chelsfield, for County E.C. Three schools, Mottingham, and extensions, Levbourne Grange Colony (£30,700), for C.C.; county architect, Maidstone.

Kilmarnock.—Houses (300) electrical work; James Hay & Steel, architects, West George Street.

Lancashire.—Police station and Court room, Heywood, for the C.C., with electrical work; S. Wilkinson, architect, 16, Ribblesdale Place, Preston.

Largs.—Café and tea garden, Auchencon Villa, for P. Nardini & Sons, café proprietors, 42, Nelson Street.

Leeds.—Houses (30); C. F. Napper, 91, Station Parade, Harrogate.

Lee-on-Solent (HANTS).—Reconstruction of the pier, with pavilion, cinema and winter garden, for the European Commercial Corporation, Ltd.; Col. J. Williams, chairman.

Lichfield.—Additional houses, Leafields; city surveyor.

Lincolnshire. — Extensions, Rauceby Mental Hospital (£50,000), for County Mental Hospital Board; Sir Herbert Bond.

Lochgilphead.—Houses; C. C. McArthur, burgh surveyor.

London.—(BERMONDSEY).—Tenements, George Row (£28,000); L.C.C. architect. (BETHNAL GREEN).—Tenements, Teale Street (£19,786); Wilson, Lovatt & Sons, Ltd., Wolverhampton. (CITY OF LONDON).—Offices, Lett's Wharf (£4,392); Hall, Beddall & Co., Ltd. (CLAPHAM).—Block of flats, Gt. Acre Court; F. Gibberd. Blocks of flats, Poynder's Road; A. F. Davies. (EALING).—Houses (30), Langdale Gardens; R. Lancaster & Son, 30, Ealing Road, Wembley. Houses (27), Thirlmere Avenue; B. Smith & Son, Ltd., Estate Office, Halsbury Road, West, Northolt. Houses (228), Wood End Hall Farm Estate, for F. Taylor, Junr., & Co., Ltd.; J. M. Wilson, architect, Western Chambers, Station Approach, Hayes, Middlesex. Four blocks of flats, Argyle Road and Cleveland Road; B. De Helsby, architect, High Park Road, Kew. Fifteen blocks of flats, Hanger Lane; T. P. Bennett & Son, architects, 41, Bedford Row, W.C.1. Factory, Hanger Lane, for Arrow Electric Switches, Ltd.; P. Bilton, Ltd., 113, Park Street, W.1. Factory extensions, Aintree Road; Philco Radio Corporation. Library, Greenford (£6,996); Evan Thomas & Sons, contractors, Hounslow. Power house for Waxlow Road; H. Goslett, architect. Extensions, Drayton Boys' School and North Ealing Infants' School, for E.C. Extensions, Rockware Glass Works, Rockware Avenue; Hal Williams & Co., architects. School, reconstruction (£5,818); A. & B. Hanson, Ltd., contractors, Southall. Factories, stores, &c., for C. Kirby, Cambridge Road; R. A. C. Churchward, architect, 12, Victoria Street, S.W.1. (HACKNEY).—Tenements, Northwold Road (£18,000); L.C.C. architect. (LAMBETH).—Rehousing, Ethelm Street (£18,000); L.C.C. architect. (ST. PANCRAS).—Block of offices, James Street; S. Chermayeff. (SYDENHAM).—Shops, Sydenham Road; G. T. Harman.

Lowestoft.—Foundry and stores, Lake View Road; F. Holmes.

Macclesfield.—Houses (28), Poynton; Kearton & Jones, builders, Congleton.

Maybole (AYRSHIRE).—Extensions, Town End Boot Factory (£2,000), for John Lees & Co., Ltd., Alloway Road.

Mottingham.—Houses (2,400); L.C.C. architect.

Newcastle-on-Tyne.—Cinema (1,600 seats), Armstrong Road; Marshall & Tweedy, architects, 129, Pilgrim Street.

Newport (ISLE OF WIGHT).—Houses (20); borough surveyor.

Northolt.—Houses (51), Church Road; H. A. Steel, architect. Houses (27), Rydal Crescent; B. Smith & Son, Ltd., Halsbury Road, West Northolt.

Norwich.—Re-erection of Spring Gardens Ballroom (electrically equipped); secretary to the directors.

Purfleet (ESSEX).—Houses (44); C. S. H. Hawkes, U.D.C. acting engineer.

Richmond-on-Thames.—Block of flats and shops, Sheen Road; Bertram Carter & Sloot.

Rugby.—Extensions, Lawrence Sheriff School (£8,000); governors.

St. Anne's-on-Sea.—"Lido" swimming pool, café, restaurant, &c., Foreshore, for a local syndicate; Halstead Best, architect, Leeds Chambers, 20, Clifton Street, Blackpool.

St. Neots.—Houses (20), Crescent Estate; E. B. Parkinson, architect.

Saltcoats.—Houses (42); burgh surveyor.

Sandbach (CHESHIRE).—Houses (21); U.D.C. surveyor.

Sevenoaks.—Five blocks of flats, St. John's Hill; A. R. & V. J. Neal

Southend-on-Sea.—Relief office, extensions (£3,500); Public Assistance Officer.

Stanley (Co. DURHAM).—Houses (250); A. Routledge, U.D.C. surveyor.

Stirling.—Two shops at Whitecross; A. & W. Block, King's Court, Falkirk.

Stoke-on-Trent.—Shop and alterations to cinema, Stoke Road; Victoria Cinema, Ltd.

Strood (KENT).—Public offices, Frindsbury Hill (£8,328); Cox Bros., builders, Lower Stone Street, Maidstone.

Sunderland.—Confectionery factory, Durham Road, for Dunn & Co.; Ranken & Co., builders, Stockton Road.

Surrey.—Schools, Cheam, St. Helier (£68,440), Epsom (£36,025), Tolworth (£13,915), secondary school, Merton, and central school, Warlingham, for County E.C.; secretary, Kingston-on-Thames.

Sussex.—Operating theatre block, Southlands Hospital, Shoreham-by-Sea; E. A. Verger, county architect, Lewes.

Torquay.—Houses (700), Cockington Village; G. S. Bridgman, architect, Torquay & Paignton.

Tyseley (NEAR BIRMINGHAM).—Extensions, Bayliss Wyley & Co., Ltd., Redfern Road (£4,000), with electrical work; A. Heming & Sons, Ltd., builders, Birmingham. Extensions, Crown Bedding Co., Ltd., Wharfdale Road (£6,000), with electrical work; J. Smith & Sons, builders, St. Vincent Street, Birmingham.

Wallasey.—Houses (257), five years' scheme; borough engineer.

Walsall.—Restaurant, Park Street (£3,000), with electrical work; Brockhurst & Wood, builders, Hatherton Street.

Warwickshire.—Buildings for the Technical College, Rugby; children's institution, Myton Grange; and technical college, Nuneaton (£10,000); county architect and Miners' Welfare Committee.

Washington.—Houses (36); G. McCall, builder, Herrington Burn.

Watford.—Houses (24), Kingswood Estate; Hillingdon Estate Co. Flats (120) and shops, Dalton House Estate; Estate Co. Shops, Gammons Lane; Fitt & Prior-Hale, architects, 3, John Street, London, W.C. Factory extensions, Rickmansworth Road; Prove Bros. Alterations and additions to Market Arcade, High Street; Market Arcade Co.

Woodford.—Houses (51), Uplands Estate; Estate Co.

Worthing.—Houses (36), St. Andrew's Road; M. R. Fletcher, architect. Houses (32), Sunningdale Road; Southwick & Downsview Estates Building Co.